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In the face of a continuously increasing demand for labor of all grades during the war period the supply constantly decreased. As a result competent men were advanced rapidly from the lower to the higher grades, leaving the employers of unskilled labor holding the bag, so to speak, and faced with the necessity of carrying on their work with forces constantly decreasing in numbers and in individual efficiency. There are many who believe that this is a condition that has come to stay. That is to say, they believe that the restoration of anything like pre-war efficiency in the ranks of unskilled labor will prove to be an impossibility. There seems to be much justification for this view when considered in the light of the probability of a greatly reduced European immigration, the principal source of supply of unskilled labor, and the probability of this country coming through the adjustment from a war to a peace basis without any necessity for a grading-down process. In pre-war days the rank and file of railroad maintenance of way labor was unskilled. Many of the officers of that department are fully aware of the necessity of immediate and radical changes in working methods and in the organization of the forces to-day. Possible means for remedying conditions include an improved track structure to reduce the amount of labor necessary, the reclassification of maintenance labor to place it where it belongs in the skilled ranks with adequate readjustment in wages, and the more general utilization of roadway machines. Relief from the first two means suggested, of necessity, must come about gradually. On the other hand, immediate relief may be had through the increased use of labor-saving devices. The appointment of a committee carefully selected, to investigate the possibilities of such machines, is a step in the right direction.

Changed Conditions Force New Methods

The terms of the standard contract between the roads and the government provide that the railway properties shall be returned to their owners at the termination of the period of federal control in substantially as good condition as when they were taken over. This provision contemplates uniform maintenance throughout the period of government control or at least the restoration in the later months of any deficiencies which may have entered in the earlier days. This involves the determination of the standard of maintenance during the three-year test period ending June 30, 1917, which is the basis of comparison. This in itself is a problem of no mean proportions. The easiest basis is that of the dollars expended, but the dollar has lost so much of its purchasing power during the last two years that it is no longer a fair criterion. The alternative is to adopt for the basis of comparison the units of material and of labor expended in the upkeep of the properties. This involves more detailed and voluminous statistics, but is the only fair and accurate measure available. It is the basis toward which the Railroad Administration is working, and while it involves elaborate calculations, this work is necessary if it is to be done accurately. Also, because of the difficulty of placing a dollar value on this work, it is to be hoped that every effort will be made to fulfill the provisions of the

What Is Standard Maintenance

contract directly and not leave any work undone to form the basis for protracted negotiations at the end of federal control.

IMPROVING THE MAINTENANCE FORCES

IT HAS BEEN many years since the maintenance of way department has had an opportunity equal to that which now exists to improve the personnel of its forces. Wages have been advanced so that in general they are now on a parity with those paid by competing industries, and especially in the skilled trades there is a plentiful supply of men. Moreover, an inspection of the personnel of the forces on most roads will show that there is a definite need for such an improvement.

It was said some time ago of the bridge carpenters on one road that they were of three classes: (1) Inexperienced men who were learning their trade and who would leave for more remunerative employment as soon as they became experienced workmen; (2) incompetent men who were unable to secure better jobs elsewhere, and (3) seasoned and competent men who preferred the low wage and easy pace of railroad work to the higher wage and speeding up tactics of the contractor. While this constitutes a serious indictment of railway bridge carpenters, it was in a measure typical of maintenance of way forces until the wage advances of the past year became effective. On most roads, even with the higher wages, this difficulty still exists to a surprisingly large extent. Now that the wages are on a level with those paid for similar labor in most localities and there is an almost universal surplus of labor, employing officers are able to exercise some choice in the formation of their forces. It is now the problem of the foremen, supervisors and higher officers, each in their respective fields, to determine the steps which it is advisable to take, the proper methods to employ, and the way best adapted to secure the highest efficiency.

Local conditions differ from place to place, yet the problem basically is the same. Many men have long contended that the most feasible way to reduce the cost of maintenance work is to pay a wage rate sufficient to attract efficient men into the service and that such men would return a greater output of work per dollar of expenditure than the cheaper labor previously employed. Now that the wages have been advanced the opportunity is offered to prove these statements. If the higher rates enable more efficient workmen to be secured and their efficiency is sufficiently higher to compensate them for the increased wage, the railways as well as the men will have benefited. Unfortunately when such efforts are undertaken one is confronted with certain restrictions which limit and frequently block all constructive measures. The most serious of these restrictions is the provision in Supplement No. 8 to General Order No. 27 (the supplement which fixed the wages in the maintenance of way department) to the effect that seniority shall prevail in the composition of gangs. This fastens on the maintenance of way department the load under which it has been struggling for years, for with wages at the lowest ebb until recently the constant migration of the more efficient men to better paying positions has left on the railroads the culls or those of the lowest efficiency. To pay the higher wage to the same inefficient employees only increases the cost of the work by the net amount of the advance, since there is little or no response from such men in the way of increased efficiency. Contractors are finding that the output of the forces has risen materially in the last few months since the shortage of men has disappeared. It is unfortunate that the hands of the local maintenance officers have been so tied that they cannot benefit likewise.

In some instances, the standards of the track, bridge and building and water service forces have been improved materially, either because of favorable local conditions or by those in charge ignoring the restrictive provisions of this order. In general, however, the supervisory officers have not been able to free themselves of this handicap. Confronted with the necessity for making heavy reductions in operating expenses, the Railroad Administration, if it is to avoid a further increase in rates, can well afford to consider the opportunity which is presented here, the utilization of which will react to the benefit of the roads for years to come and may result in placing the maintenance of way forces on a higher wage basis permanently. Obviously, if the roads cannot benefit from the increased expenditures in the form of higher wages sound business judgment will demand that they reduce these wages at the earliest possible opportunity. We believe this will be most unfortunate to the future efficiency of the maintenance of way department and it is with the desire to justify the present high wages by an increased output of work from labor that we suggest that this restriction be removed, at least in large measure. Unless labor is willing to render a fair day's work for the present high wage, sound business judgment demands that the wage be reduced to the value of the work given at the first opportunity.

SELECTING THE INSPECTOR

WHAT TYPE of man makes the best bridge masonry inspector? The publication on another page of this issue of a discussion on masonry inspection, following similar dissertations in previous issues on the inspection of steel and timber structures, emphasizes the importance of this question. With the increased use of scientific methods in the maintenance of railway structures, it is but natural that some thought should be given to the idea of using technically-trained men for this important work.

The problem has a somewhat complex aspect because of the difference in the nature of the inspectors' duties and responsibilities on different classes of structures. In the case of timber trestles responsibility for determining the need of renewal is imposed very largely on the inspector himself. As stated in the discussion of timber structures in last month's issue, ability to pass on the safety of wooden structures is attained only after an extended experience that will enable a man to judge of the conditions of a stick of timber from superficial examination. Technical training is undoubtedly of some advantage to the experienced man, but is really of little value in the absence of practical experience.

Steel bridge inspection imposes some decidedly different duties on the inspector. Aside from discovering such defects resulting from wear or corrosion as call for repair work such as redriving new rivets or repainting, the object of steel bridge inspection is to obtain such information concerning the physical condition of the structure as will enable the designer and the bridge engineer to pass intelligently on the calculations made from the plans on file, for the safety of the bridge under increased loading. To present such information satisfactorily it is of special advantage for the inspector to have a thorough knowledge of steel bridge design so that he may know the importance of the defects he discovers from the standpoint of their effect on the strength of the structure, but still more important is an ability to record what he finds in writing and with the help of neat, accurate sketches, in such a way that the men in the office may know exactly what he means. In the case of masonry the duties of the inspector imply a combination of those imposed in the

inspection of timber and steel. Judgment is essential because of the necessity for determining from external appearance the approximate nature of internal disturbances. However, since the difficulty in masonry work is more often the result of over-stress rather than of faulty material, a knowledge of the mechanics of structures is of more value than in timber structures. But in the simpler piers and abutments as built in stone masonry, the experienced non-technical inspector is well able to judge of the seriousness of any ordinary situation from his personal knowledge of the consequences of such conditions from other situations brought to his attention. The use of reinforced concrete in recent years has complicated this matter somewhat, but even with these more complex structures the inspector of the old school has considerable advantage in his ability to distinguish between the serious and the inconsequential in the defects brought to his attention. But here, as in the case of the steel structure, the situation is complicated by the present tendency towards more scientific work in repairing and renewing masonry. There is now more of a need for accurate information concerning the nature of defects in the old structures because of the movement toward accurate, careful design of underpinning, jacketing and buttressing, etc., necessitating the preparation of plans by a trained designer. To do this accurately it is necessary to have accurate information on the actual conditions of the structure which the old-time inspector seems to have difficulty in preparing.

This discussion draws attention to the need of thoroughly competent inspectors. Except in the case of the timber trestles of the usual type, there seems to be a distinct advantage in the employment of the technically trained man, provided responsibility is not placed upon him until he has had adequate practical experience.

MEANWHILE THE PATIENT IS SINKING

THE OUTSTANDING event of the month at Washington, in so far as railway men are concerned, has been the controversy which has developed between the Railroad Administration and the Industrial Board of the Department of Commerce relative to the new schedule of prices for steel products and particularly for steel rails. When this schedule was announced the fact that it involved considerable reductions in prices from those then existing was taken by the public to indicate that it marked the beginning of a period of industrial activity, for it was thought that these lower prices would induce purchasers to enter the market. It soon developed that the Railroad Administration did not believe that the reductions had been great enough and that it proposed to remain out of the market. This it has continued to do until the present time.

In the absence of complete data it is difficult, if not impossible, to pass on the merits of this controversy. However, it is not so hard to determine what will be the result if the railways do not soon secure materials. It is true that there is still a considerable tonnage of rails under contract and yet to be rolled, but some of the mills have almost, if not entirely, filled their orders. The roads have not made their normal renewals of rail for several years. For this reason, it is unfortunate if any rail mills are idle at this time of the year when the season of renewals should be actively under way. It is highly important from the standpoint of the railways that the controversy should be settled as soon as possible so that orders may be placed and the roads enabled to push their rail relaying programs as rapidly as possible. It is to be hoped that the reopening of the study of these prices which the President has ordered may bring about a settlement of the controversy and enable work to proceed.

LETTERS TO THE EDITOR

BREAKING ICE GORGES

Richmond, Ind.

TO THE EDITOR:

I have read with much interest the article in the March issue of the *Railway Maintenance Engineer* entitled "The Menace of the Ice Gorge." In handling a problem of this character I have found that a pile driver hammer securely fastened to the lead line of a derrick mounted on a car such as is commonly used to handle bridge timbers, steel rails, and other heavy maintenance material worked successfully. Such a derrick should have a boom about 40 ft. long, so as to reach some distance out from the bridge. When handled by a work train it can be moved to any point on the bridge and the hammer allowed to drop onto the ice, breaking it up so that it will pass under the structure. I have found this method rapid and economical since one can deliver many effective blows in a relatively short time. The expense is small, as two men and the foreman in addition to the crew of the work train will break up almost any gorge. B. F. GEHR,

Master Carpenter, Pennsylvania Lines.

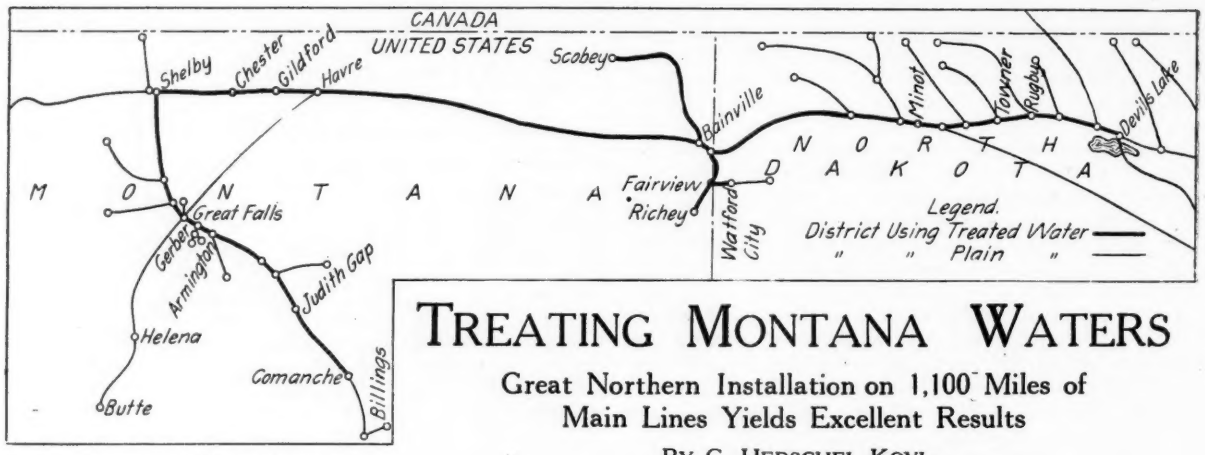
NEW BOOKS

Modern Management Applied to Construction. By Daniel J. Hauer, consulting engineer. 6 in. by 9 in., 194 pages, illustrated. Bound in cloth. Published by McGraw-Hill Book Company, Inc., 239 W. 39th St., New York. Price $2.50.

As indicated by the title, this book treats of the subject of scientific management from the standpoint of the construction contractor and for that reason it is unique in this field. The author frequently makes use of a dialogue style that does much to hold the interest in a subject that could easily become very tedious. Dialogue and homely examples are used particularly in pointing out the difference between scientific management and that which it is designed to replace. The subject matter is divided into chapters on Principles of Modern Management, Plant Design, Motion and Time Studies, Application of Modern Management, Cost Keeping and Bookkeeping, Systematic Instruction and the Effect of Management on the Workmen. Under motion study considerable space is given to shoveling and shovels.

Trautwine's Civil Engineer's Pocketbook. Twentieth edition, by John C. Trautwine, revised by John C. Trautwine, Jr., John C. Trautwine, third. 6 in. by 4 in. 1528 pages. Bound in flexible leather. Published by Trautwine Company, 257 South Fourth street, Philadelphia. Price $6.

The first issue of this twentieth edition constitutes the 140th thousand of this well-known reference on civil engineering. The particular object of this revision was the extension and revision of the section on railway engineering. Some idea of the scope of this revision is indicated by the fact that the portion on track and track work has been extended from 35 to 94 pages, the matter on curves from 10 to 108 pages, and the subjects of train resistance, train operating costs, etc., are treated for the first time in a total of 38 pages. The discussion of railway construction costs, which was previously accorded only brief mention, is allotted 36 pages. The treatment and arrangement of the matter in this issue conforms very closely to the typographical standards of previous editions and the established policy in this work of using only such matter as has become thoroughly established usage is maintained in this latest edition.



Map of the Treated Water District

TREATING MONTANA WATERS

Great Northern Installation on 1,100 Miles of Main Lines Yields Excellent Results

BY C. HERSCHEL KOYL,
Engineer of Water Service, Great Northern, St. Paul, Minn.

DURING THE PAST six years the Great Northern has been developing a system of water treating adapted to its needs. Of this the following is a brief description, with some account of the waters, treating plants, methods of inspection, and results.

The Great Northern crosses a strip of country 600 to 700 miles wide, just east of the Rocky mountains, which receives less than the average rainfall and the waters of which contain more than the average dissolved mineral water, particularly of the sodium salts. The trouble used to come not alone from the amount of matter dissolved in the water, but from its variety, because any boiler will leak and foam if it receives alternately hard water and alkaline water. The principal work of the water treating plants has been to reduce all of these waters to a common standard of hardness and alkalinity, and for this essential we have installed a plant at every water station on the treated water district.

Work was begun in 1912 and now, in 1919, we have more than 1,100 miles of exceedingly bad railroad water converted into water satisfactory in all respects for its content of sodium sulphate. We have practically abolished scale, leaks due to water, and clogging of the injector and branch pipes. We have not altogether abolished foaming (due to the accumulation of soft sludge deposited in the boiler from the 3 grains per gallon of calcium carbonate unavoidably left in the water when treated cold), but we seldom hear about it. We have not abolished pitting and grooving (which are not produced by chemical action of the water), but we have had a set of tests running for some months from which we hope to be able shortly to add something to the present knowledge on this subject.

THE WATERS

Many interesting and important problems are presented on a road having so many kinds of water. In Minnesota, surface water of fair quality is plentiful in rivers and lakes, and when these are not convenient to the railroad it is generally possible to get usable water in wells of moderate depth. West of Minnesota to the Rocky Mountains, railroad water *must* be taken from the surface or near it because deep waters are so laden with sodium salts as to be practically unusable.

The waters of the Great Plains of North Dakota and Montana are divided into two classes at a line running roughly north and south through Minot, N. D. East of this line the deep waters are charged mostly with sodium chloride (common salt); west of this line with sodium sulphate (Glauber's salt); and in each the charge is so heavy, several hundred grains per gallon, as to make them impossible as railroad waters. Of the surface and sub-surface waters, all contain calcium bicarbonate and nearly all magnesium bicarbonate; while east of the Minot line they contain also calcium and magnesium sulphate, but west of the Minot line sodium bicarbonate. At Minot these substances are so nearly balanced that in summer the Mouse river contains 3 grains per gallon of sodium carbonate and in winter 3 grains per gallon of magnesium sulphate. It is understood that this is a general classification, there being a few individual exceptions; but east of Minot locomotive flues and sheets accumulate scale and burn, while west of Minot they alternately accumulate scale and lose it, therefore, they get alternately hot and cool, alternately expand tight in the flue sheet and contract from it, and therefore leak.

In each state there is also some excellent water flowing south in gravel beds from isolated mountain peaks—the Turtle mountains on the Canadian border of North Dakota and the Sweetgrass hills on the Canadian border of Montana. In Dakota, just below the surface soil, is clay of great depth, but lying in east and west waves so that the troughs of the waves run north and south. In the course of years, these troughs have been nearly filled with gravel and sand from the weather worn peaks of the Turtle mountains, and all year long these gravel veins carry excellent water from the mountains south through Dakota. I do not know the total number of these troughs nor their length, but I am sure of four which are 60 miles long each, and there are numerous shorter ones. In Montana somewhat similar conditions exist about the Sweetgrass hills.

Then we have a most interesting set of waters in shallow lakes which we use as reservoirs. These lakes are crowded with weeds and small fish. The water is supplied by melting snow and rain. In summer, weeds and fish are growing and the quality of the water is fair; but toward winter organic decay sets in, of which the product is marsh gas, and in hard water eventually hydrogen sulphide. Before ice forms, this gas escapes to the air; but later the escape is cut off and great concentration takes place in the water, with results to the boilers which are very serious. Sweetwater Lake, so named by the Indians when the lake probably had a current, is our most striking example; and before we treated the water engines sometimes could not make the main line from the roundhouse, although now we use it with conspicuous success.

Nearly all of the surface waters are growing yearly

harder because of the more extended plowing of nearby lands. Still, in springtime, most of them are fairly soft, though they grow gradually worse with the season until in late winter several of the reservoirs and at least one of the streams exceed 100 grains per gallon in hardness.

For locomotive purposes all these waters must be put into the same chemical condition, which is done except as to the varying content of sodium sulphate or chloride. It is the aim to maintain all treated waters, clear and colorless, at 3 grains per gallon hardness and one extra grain alkalinity due to sodium hydrate. The treating plants are of the "continuous" type with 40-min. mixing tanks fed from the bottom, the plants varying in working capacity from 20,000 gal. per hour at the principal stations to 5,000 on the branches. Each has an engine with two pumps controlled by clutches, the pumps operating simultaneously, with the raw water pump delivering to a water wheel which furnishes power for all the mixing devices and the treated water pump working at the same rate and delivering to the track tank.

The plant design has varied in detail from year to year as we have gained experience of railroad wayside conditions, but it has always retained the essential feature of a 40-min. mixing tank fed from the bottom—this for the reason that raw water and chemical reagents do not mingle by diffusion in any practicable time and that experience shows the necessity of a minimum of 25 min. mechanical stirring if the reactions are to be completed in the mixing tank and the precipitate deposited in the settling tank instead of in the track tank. The mixing tank is fed from the bottom so as to provide therein a mass of old precipitate for the cohesion of the microscopic and slow settling particles which are nascent during the last reactions when combining molecules are few. We do not use filters in any form, and for wayside work have discarded automatic regulating devices and feed the chemical boxes every hour. Each plant is housed and in winter is kept warm by a hot water system distributed about the lower walls.

We put a pumper at each plant; a water inspector in charge of each engine district, usually of 9 or 10 stations, and a general inspector in charge of 5 or 6 district inspectors.

THE CHEMICAL TREATMENT

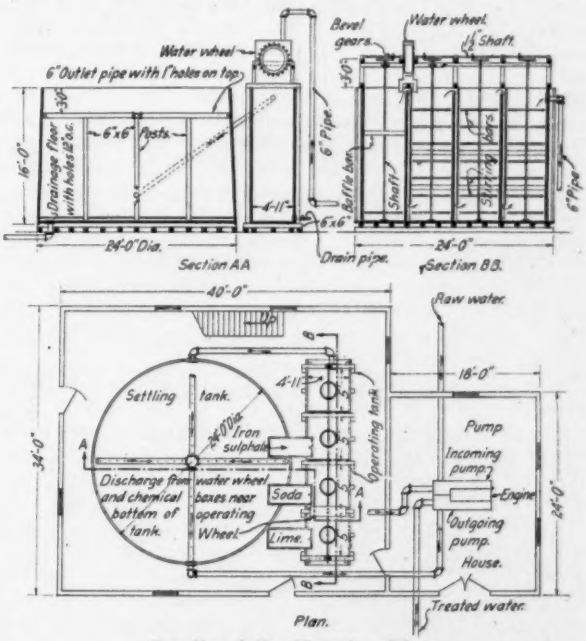
The character of the treatment varies from plant to plant with the character of the water, and may vary at any plant from day to day; but all cases are covered by the use in proper proportions of hydrated lime, soda ash (sodium monocarbonate) and sulphate of iron (ferrous sulphate).

Hydrated lime is used to extract the carbonic acid, which brings about (1) the precipitation of the scale-making limestone carbonates (down to 3 grains per gallon or less), (2) the conversion of sodium bicarbonate into sodium hydrate, and (3) the weighting of the particles of light suspended mud and organic slimes. Soda ash is used to replace completely the scale-making limestone sulphate by non-scaling medium sulphate. Ferrous sulphate is used (1) for the treatment of the last 3 grains of calcium carbonate so that it will not clog the injector or branch pipe, (2) for the conversion of caustic sodium hydrate into neutral sodium sulphate, and (3) for the further weighting and more rapid settling of particles of light suspended matter.

The treatment with lime was the gift to the world, in 1840, of Dr. Thomas Clark, professor of chemistry in Mareschal College, Aberdeen, Scotland; the treatment with soda ash was proposed by William Porter, an Englishman renowned for his advances in water softening, and the treatment with ferrous sulphate is my own device for preventing after-precipitation and particularly the clogging of the locomotive injector and branch pipe.

THE RESULTS

The first treating plant in 1911 was for demonstration purposes on the three stationary boilers of the roundhouse at Minot, N. D. These boilers had been fed from the hard and dirty water of the Mouse river; had been washed, one each day; had received the exclusive service of one boiler maker; had been dismantled, thoroughly cleaned and the flues retipped or renewed each summer, and, even so, had consumed $10,000 worth of coal per year and delivered about $5,000 worth of steam. The demonstration treating plant consisted of an old wooden water car, partitioned, fitted with stirring apparatus, set in the roundhouse, connected at one end with the track tank and at the other end with the stationary feed water heater. The river water varied from a colored, muddy, comparatively soft water in spring to a comparatively clean water of 40 grains per gallon hardness in late winter. The treated water was kept throughout the year colorless, clear and at a hardness of 3 grains per gallon (calcium carbonate) and at a total alkalinity of 5 grains per gallon, the extra 2 grains being sodium hydrate.



Details of the Treating Plant

The results in the boilers were immediate. In 10 days the shells and lower flues were clean, and when the loosened masses of scale above were broken so that they could fall through between the flues the whole boiler interiors became clean. Thereafter for a year the flues were black and the master mechanic reported for the year "no scale, no leak and not a tool touched to a boiler." During this year, too, there was no lack of steam for any purpose and there was a hitherto unknown "snap" to the tools operated by compressed air. We burned as much coal as before, but we made twice as much steam.

Before the year was out instructions had been given for equipping with treating plants the 10 water stations for locomotives on the engine district between Devils Lake and Minot, and this was accomplished during the summer of 1912. During the winter of 1911, with untreated water, the Minot roundhouse handled an average of 600 engines per month and maintained a certain force

for boiler repairs and washing; during the winter of 1912, the Minot roundhouse handled an average of 900 engines per month, of which 600 were from the untreated water sections and 300 from the treated water district between Devils Lake and Minot, and during this winter the crews for boiler repairs and washing were the same as during the winter of 1911. This looks as though the treated water boilers cost nothing for washing or repairs, but the fact was that the other boilers all took treated water at Minot before going to their hard water work and the effect of this one tankful of treated water every two days was quite marked in their repair and washing bills. The flue renewals at Minot roundhouse in 1911 with raw water were 491; in 1912, with heavier traffic and raw water most of the year, were 676, and in 1913, with circumstances as stated above, the total renewals were only 183.

While the old scale was coming out of the boilers there was considerable foaming, but this gradually disappeared, and with freedom from leaks boiler operation became something of an exact science. The effect on the locomotives was such that since then the addition of treating plants has been continuous, until now there are 77 in use, protecting 1,156 miles of traffic through the wheat fields and the cattle country. They are attached to every water station except one from Devils Lake, N. D., west to Shelby, Mont., a distance of 652 miles; they run in the same manner from Shelby southeast to Comanche near Billings, Mont., a distance of 295 miles; they protect two important branches of 209 miles, and there are 3 other plants where the division equipment is not yet complete.

The general benefits accruing to the railroad are the usual saving in coal and in boiler repairs, and the saving of time on the road, and the greatest of these is the saving of time on the road. It is not merely that boilers do not leak and fail; it is that the service is dependable, and that every officer can reckon on speeding up his department accordingly.

The following note, under date of January 20, 1919, from the general master mechanic of the Central district concerning the work on the Billings line, represents fairly the conditions and results along the road. "The treating plants were put into operation between Great Falls and Billings during October, November and December, 1917, and we were able to have passenger power use treated water as early as October. In December, 1916, we had 6 complete failures on the Billings district on account of flues leaking. In December, 1917, we had one partial failure, and since that date we have not had an engine failure on account of flues leaking nor have we heard of flues leaking between Great Falls and Billings.

"We used to bombard crown sheets on this district once a month to remove scale that adhered around crown bolts and stays. The stationary boilers at Judith Gap had to be washed once a week and crown sheets scraped in order to keep scale off sheets. The boilers now go 30 days and there is no scale.

"Before treated water was used our helper engines at Armington could not stay in service over 5 days on account of flues leaking, and the Neihart engine which laid over at Armington had to come in once a week. But since Armington water has been treated the engines stay 30 days, at which time they are brought in for monthly inspection and washout.

"Gerber is the best illustration of what water treating has done. Our Sand Coulee engines use this water only, and a set of flues sometimes used to last six months, but never longer. Since Gerber water has been treated the scale has all come off from stays, crown bolts and flues; and with the aid of a little kerosene the flues and sheets in engine 1204 are as clean as the day she came out of the shop. This engine has now been in service on this one district 15 months as against a maximum life of 6 months with untreated water.

"I cannot say that treated water has reduced our boiler washing, because, on account of the concentration of sodium sulphate and the sludge in the mudring, we think it best not only to change water, but to wash every round trip, the same as before."

On the Montana division main line from Williston west to Cut Bank, a distance of 420 miles, treating plants were installed during the autumn of 1914. Improvement in locomotives and in service followed at once, and increased regularly was evident until in February, 1915, a comparison with the month of February, 1914, under practically the same weather conditions, gave the following results:

	1914	1915
Boiler repair and washing, hours per week	2000	1000
Boiler failures on the road	10	0

AVERAGE TONS PER TRAIN

	1914	1915	Increase Tons	Increase Per Cent
Williston to Glasgow	1180	1691	511	43½
Glasgow to Williston	1602	2152	550	34
Glasgow to Havre	1192	1769	577	47½
Havre to Glasgow	1810	2297	487	27
Havre to Cut Bank	936	1241	305	33
Cut Bank to Havre	1466	2134	668	45½
Whole main line	1364	1881	517	38

In February, 1919, operating conditions in Montana were quite different and most of those engines were working on other divisions. One remains, however, to prove not only that the loading exceeded that of February, 1915, but that the time was less.

Our boiler washing on treated water districts averages about half what it used to be. The roundhouse cost of handling an engine is much reduced. If we succeed in doing away with pitting and grooving, boiler repairs will be almost nil.

No one need expect to get perfect boiler service the first year after installing a set of treating plants, because there are many things other than water which will make a locomotive boiler leak. In the old hard water days, if a boiler leaked, it was easiest to blame it on the water and let it go. But in our case we found that, with treated water, boilers would go through a North Dakota or Montana winter without a sign of leak, and then the first warm day in spring there would be an epidemic; and it took a long time to trace this to a tendency of inexperienced fireman to imagine that a sun which was hot on the back raised outside air to the temperature of the firebox.

It will be found, too, that in hilly districts there is a constant tendency on the down grade to permit thin spots in the firebox and consequent local flue chilling, and there are other causes of unequal heating and of resultant flue leaking well known to boiler men. In bad water districts so much has been blamed on the water that these other matters have not received as much attention as they deserved; but with the advent of treated water and the co-operation of everyone connected with the boiler service in making a careful report of every case of leaking, we are gradually running down these causes and endeavoring to eliminate them.

This is a cold country for a short time every winter, and water-treating plants must be carefully housed and heated. The cost of the housing and the heating apparatus is more than the cost of the plant proper, but it is a necessity, for in winter the water is worst and must be most carefully treated; in winter engines require more water than in summer because of the heating and other extra work they do, in winter there are more engines for the same traffic because the trains are shorter, in winter

much water is wasted at coach hydrants and other places to keep the pipes and hose from freezing, in winter the men are all under strain and a frozen pipe line or a failure at a treating plant might disarrange traffic very badly.

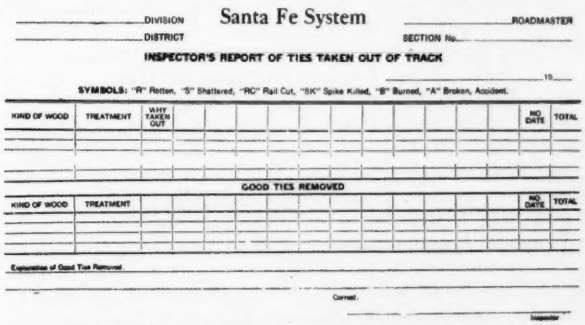
Not only are our plants costly in construction because of the climate and the service we aim to give, but also our operating expenses are heavy because of the constant patrol and inspection maintained. Improperly treated water is little better than water not treated at all; and the amount of treatment depends not alone on the kind of raw water (which itself may change 20 grains per gallon over night), but on the rate of pumping, which may be affected 10 per cent or more by an obstructed suction, a flaw in the pump packing, some derangement of the pumping engine, a drop in the voltage of an electric current, or other causes; and under our rule "Get there before it happens, not after," the inspector's duty is not only the regular and frequent examination of the character of the treated water, but the examination, as regular and frequent, of all the appliances which affect the operation of, or the rate of water flow to, the plant. For this reason, our water inspectors are the trained and promoted pick of our pump repairers.

The sending of a weekly water sample to a chemist a couple of hundred miles away is good enough for record purposes; but how is the chemist to know why the treated water is not correct, or how is he to know that the pump will not be repaired by the time the pumper receives the data for the changed treatment? I have seen many abandoned water-treating plants on railroads and in other places, but never one which had been regularly inspected on the ground. The value of a properly run treating plant for locomotive service is so much greater than the cost of inspection, with interest and depreciation on its cost of construction, and the value of one improperly run is so small that I think there is no question of method. What is worth doing at all is worth doing well.

I have never known a case of locomotive priming with properly treated water which I did not consider traceable to the accumulation of sludge from the last 3 grains per gallon of calcium carbonate which cannot be taken out while the water is cold, and I am confidently looking forward to the time when all boilers will have blow-offs in the front and back ends as well as in the throat sheet, *all operated from the cab,* or similarly operated blow-offs connected to properly perforated pipes inside the boiler bottom and the mud ring. Then 5 seconds' blowing would do more good than 60 seconds' blowing under present conditions, and there would be almost no necessity for boiler washing.

Checking the Service of Treated Ties

WHEN A CENTRAL western road of 4,300 miles of main track and 9,500 miles of all tracks is able to secure an average life of over 16 years from all ties in main and side tracks, it is an indication of consistent attention to all phases of timber protection. This is the record established on the Atchison, Topeka & Santa Fe proper, including those lines east of Albuquerque, N. M., and north of Purcell, Okla. On these lines the average number of ties inserted annually per mile of track decreased from 259 for the five-year period ending with 1901 to 199 for the five years ending with 1916, or 23 per cent. This is equivalent to a saving of 570,000 ties annually. Since equivalent reductions have been effected on the Gulf and Coast lines of the system the total annual reduction in tie consumption on the entire system as a result of treatment and other protection of the timber will aggregate 1,000,000 ties annually.



Santa Fe System

_____ DIVISION _____ ROADMASTER

_____ DISTRICT SECTION No. _____

INSPECTOR'S REPORT OF TIES TAKEN OUT OF TRACK

_____ 19__

SYMBOLS: "R" Rotten, "S" Shattered, "RC" Rail Cut, "SK" Spike Killed, "B" Burned, "A" Broken, Accident.

KIND OF WOOD	TREATMENT	WHY TAKEN OUT											NO. DATE	TOTAL

GOOD TIES REMOVED

KIND OF WOOD	TREATMENT												NO. DATE	TOTAL

Explanation of Good Ties Removed _____

_____

Correct.

_____ Inspector

Form Used by Inspector in Making Report

The most recent steps to be taken in an effort to secure the maximum possible life from ties and other treated timber has been the systematic inspection by the treating department of the ties taken out of tracks. Beginning on May 15, 1918, timber inspectors on the staff of the manager of treating plants for the system were sent out to inspect ties taken out of tracks by the track forces. The latter are not required to hold these ties indefinitely, but the inspectors are instructed to examine all such old ties as they find along the right-of-way at the time of their visits.

Several objects are obtained by these inspections, although the fundamental one is to secure the maximum possible service from the treated ties. Therefore, the primary duty of the inspector is to ascertain if any ties are being removed from the track sooner than is necessary. Another object is to determine the ultimate cause of removal. This information has not been obtained satisfactorily in the past because of the habit of section foremen to report the cause in almost all cases as decay. Thus it is expected that the work of the inspectors will afford valuable information on the deterioration of ties through defects in the treatment, mechanical wear, improper handling or any other causes.

The inspectors were instructed from the start that this work was not to be conducted simply as a check on the maintenance forces, but rather in a spirit of co-operation or assistance, it being the idea that the full benefit of this system of inspection cannot be obtained unless hearty co-operation is obtained from the division forces. To this end the motor cars used by the inspectors are provided with an extra seat so that the roadmaster may make the trip over his subdivision with the inspector.

The roadmaster is advised in advance when to expect the inspector so that he may readily arrange to accompany him. With the roadmaster present the inspector can reach a better understanding regarding the ties inspected. Fundamentally this affords an intimate contact between the roadmasters and the timber-treating department, whereby the difficulties of each can be discussed.

A similar spirit of co-operation is maintained with respect to the division superintendents. Each superintend-

SERVICE TESTS OF TIES ON THE SANTA FE

Kind of Wood	Treatment	Station or Line	Number Originally Inserted	Date Inserted	Now in Track	Number Removed														Kind of Ballast	Size of Tie Plates	Kind of Spike	Tons Traffic per Annum
						Rotten				Mechanical Wear			Exp. Purposes			Other Causes			Total				
						1915	1916	1917	1918	1915	1916	1917	1915	1916	1917	1918	1915	1916	1917	1918				
Hewn Pine	Rueping	Chillicothe, Ill.	173	1905	None									4	3				166		173	Gravel	6 x 8—7 x 9	Cut	10,172,186
Hewn Pine	Rueping	Marceline, Mo.	304	1905	171		8			12	6	15		2				90			133	Gravel	6 x 8—7 x 9	Cut	10,369,805
Hewn Pine	Rueping	Sutton, Kan.	44	1905	22					4		1	17								22	Slag	6 x 8—7 x 9	Cut	6,499,249
Hewn Pine	Rueping	Ponca City, Okla.	190	1904	181					6				2		1					9	Rock	7 x 9	Cut	2,550,296
Hewn Pine	Rueping	Bliss, Okla.	275	1904	262					6	5	2									13	Rock	7 x 9	Cut	2,550,296
Hewn Pine	Rueping	Perry, Okla.	27	1904	27																	Rock	7 x 9	Cut	2,550,296
Sawn Pine	Rueping	Perry, Okla.	366	1904	366								3								6	Rock	7 x 9	Cut	2,550,296
Sawn Pine	Rueping	Garnett, Kan.	384	1905	310		26	12				12		2							74	Rock	7 x 9	Cut	4,821,390
Sawn Pine	Rueping	Argonia, Kan.	572	1905	330			4	20		56	98							60		242	Rock	7 x 9	Cut	5,131,506
Sawn Gum	Rueping	Hutchinson Main Line	390	1907	379			4	1		6										11	Rock	7 x 9	Cut	4,904,181
Sawn Gum	Rueping	Hutchinson Cut-off	230	1907	230																0	Cinders	7 x 9	Cut	3,003,686
Sawn Gum	Rueping	Plevna, Kan.	262	1907	258						3	1									4	Rock	7 x 9	Cut	4,904,161
Sawn Red Oak	Rueping	Plevna, Kan.	52	1907	51							1									1	Rock	7 x 9	Cut	4,904,161
Hewn Pine	Rueping	Ottawa, Cut-off	24,198	1906	24,198							16						7		8	30	Rock	7 x 9—7 x 9	Cut	14,327,691
SawnBeech	Rueping	Smithshire, Ill.	384	1912	384																0	Gravel	7 x 9	Cut	10,172,186
SawnBeech	Rueping	Marceline, Mo.	99	1912																	0	Gravel	7 x 9	Cut	10,369,805
SawnBeech	Rueping	Tecumseh, Kan.	160	1912																	0	Rock	7 x 9	Cut	5,902,490
SawnBeech	Rueping	Newton, Kan.	151	1912	151																0	Rock	7 x 9—7 x 9	Cut	15,034,755
Hewn Pine	Rueping	Newton, Kan.	149	1913	149																0	Rock	7 x 9	Cut	15,034,755
Sawn Pine	Rueping	Newton, Kan.	151	1913	151																0	Rock	7 x 9	Cut	15,034,755
Hewn Red Oak	Rueping	Newton, Kan.	150	1913	150																0	Rock	7 x 9	Cut	15,034,755
Sawn Gum	Rueping	Newton, Kan.	150	1913	150																0	Rock	7 x 9	Cut	15,034,755
Hewn Pine	Rueping	Hutchinson Cut-off	41,021	1910	40,828							32									193	Rock	7 x 9	Cut	15,034,755
Sawn Pine	Rueping	Hutchinson Cut-off	9,436	1910	9,427							9									9	Rock	7 x 9	Screw	4,904,161
Hewn Gum	Rueping	Hutchinson Cut-off	14,497	1910	14,497																0	Rock	7 x 9	Screw	4,904,161
Hewn Ohia	Untreated	Hutchinson Cut-off	132	1910	132																0	Rock	7 x 9	Screw	4,904,161
Sawn Ohia	Untreated	Hutchinson Cut-off	108	1910	106																2	Rock	7 x 9	Screw	4,904,161
Hewn Pine	Rueping	Hutchinson Cut-off	13,600	1910	13,600																0	Rock	7 x 9	Screw	4,904,161
Hewn Pine	Burnett	Newton, Kan.	6,357	1904	1,437																4,920	Rock	7 x 9	Cut	15,034,755
Hewn Pine	Burnett	Newton, Kan.	9,251	1905	5,008					2,257	219	540				1,904					4,920	Rock	7 x 9	Cut	15,034,755
Sawn Pine	Burnett	Newton, Kan.	5,008	1905	2,446					572	434					140				50	1,243	Rock	7 x 9	Cut	15,034,755
Sawn Pine	Burnett	Newton, Kan.	2,517	1904	853					1,054	349	86				175					4,664	Rock	7 x 9	Cut	15,034,755
Hewn Pine	Burnett	Newton, Kan.	40	1905	5						16	6				13					35	Rock	7 x 9	Cut	15,034,755
Sawn Pine	Rueping	Walton, Kan.	10,994	1917	10,994																0	Screening	7 x 9	Cut and Screw	15,034,755
Sawn Pine	Rueping	Walton, Kan.	1,394	1917	1,394																0	Screening	7 x 9	Cut and Screw	15,034,755
Hewn Oak	Rueping	Walton, Kan.	4,395	1917	4,395																0	Screening	7 x 9	Cut and Screw	15,034,755

*Eight burned. *70 removed account of changing switch.

ent is sent a copy of the inspector's daily report on his division, and he also receives copies of the monthly summaries of the daily reports of the work on his division, the monthly reports also being sent to the chief engineer, general superintendent and general manager. It is the plan to have these inspectors cover the entire system, working continuously. The inspections cover all timber bridge materials, both treated and untreated, as well as the track work.

In 1906 the Santa Fe commenced treating its ties with creosote by the Rueping process and continued this practice until compelled to return to zinc treatment in 1914, on account of war conditions, which made it impossible to secure creosote in sufficient quantities so that it could be used in treatment of ties.

Success of a plan such as this depends largely on the hearty co-operation of division officers. This has been secured by having it clearly understood that the inspectors were sent out to assist the division officials in securing the maximum life of treated material, and inspectors were instructed that it was not their function to unduly criticise what they found, but by close contact with roadmasters, section and bridge foremen, to discuss the various conditions as they occurred with a view of finding some remedy, always remembering that there was as much necessity for rotten or unserviceable material being removed from the track as there was against removing serviceable material.

Specific evidence of the results being secured on the Santa Fe through the use of treated ties will be found upon examination of the accompanying table showing the results of the 1918 inspection of the special test sections of track on the road. The rail in all cases was either 85 or 90 lb., with 3,200 ties per mile of track.

CONSERVATION OF MATERIALS*

BY W. F. JONES

General Storekeeper, New York Central, West Albany, N. Y.

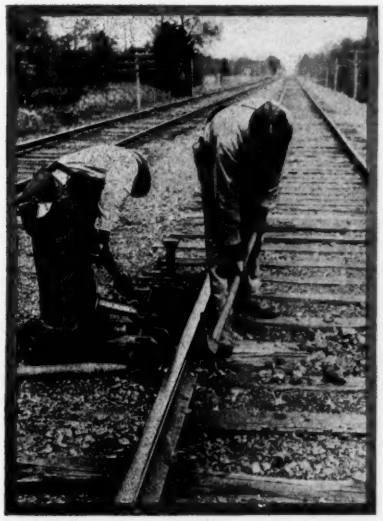
ON THE NEW YORK CENTRAL we have established scrap platforms; we collect all the material that is discarded by every department, and take it to those scrap platforms. We sell what we cannot use, and we reclaim what can be worked over. We do not neglect the little things, either. Generally the big things take care of themselves, because they are self-evident at all times; but it is the little things that tell.

In loading scrap materials for the scrap platforms, critical inspection should be made to avoid sending anything there that can be used on your own division or on your own section. Hany articles come to the scrap platforms that, in the course of time, have to go back, probably without any reworking. That is due, possibly, to the hurried manner in which you have to load the material. Every article of scrap or second-hand material that you may want to send to headquarters should be inspected thoroughly before it is sent in, because you will find a lot of material that you can use over.

Do not devote all of your time and attention to matters in your own department. In going through the yards, around round houses or shops, you have often seen air escaping from air pipes and have passed it by without a thought. If you cannot make the necessary slight repairs, call the matter to the attention of the department responsible, for every pound of air that goes out of that leak requires so many pounds of coal at the power house. If you find lanterns lighted at a station that should not be lighted at that particular time, call the attention of the station agent to it. These may seem like small things, but it is the little things that count.

*Abstracted from a discussion at the Roadmasters' Convention at Chicago on October 17, 1918.

ACCIDENT PREVENTION FOR TRACKMEN*



A Set of Regulations which is Designed to Promote Safe Practices in Doing Track Work.

BY ROBERT HOLLAND,
Division Roadmaster, St. Louis—San Francisco, Neodesha, Kan.

1. FEW track foremen place their hand cars on the track properly. Cars are run from tool house to track at right angles, one end is lifted and turned parallel with the rail—invariably this end of the car is held up until the other end is placed on the rail. This often results in personal injury. The turning end should be placed on the rail, thereby avoiding any chances of injuring the hands of the men by coming in contact with the rail or causing any extra heavy lifting.

2. Track tools should be placed on a motor or hand-car in such a manner that when the car is in motion they will not jolt down against the wheels or cause men to rearrange them while the car is in motion, thereby resulting in personal injury.

3. In moving to the point of work, all men should remain seated until the car is stopped. Often trackmen are injured on account of being allowed to stand on a motor car while it is in motion.

4. Motor cars or hand cars should not be started from the side—they should be started from the rear. This is the cause of a great many personal injuries, on account of men stumbling or making a misstep and the motor car running over their feet.

5. Men should be placed on motor or hand cars in such a way that they have a clear view both forward and back, so as to observe any train movement in either direction.

6. Motor or hands cars should not be run around curves where the view is obstructed—they should be stopped and a flagman sent ahead, and should not proceed until they get a signal from the flagman, thereby avoiding any chances of coming in contact with trains, which generally result in personal injury.

7. On reaching the point of work, the motor car or hand car should be placed to clear the nearest rail at least six feet.

8. Sharp-edged tools, such as scythes and snathes, adzes and axes, carried on a motor or hand car, should be protected by a sheath; scythes should always be carried knocked down, never fastened to the snath. It only takes a few minutes to attach the scythes to the snaths on arriving at the point of work, thereby avoiding any chance of personal injury to the men on the car.

9. Trackmen should never be allowed to jump from a car while it is in motion or about to come to a stop; they should remain seated until it has stopped. This applies to motor cars, even if protected by railings.

10. Hand cars and motor cars should be brought under full control at all road crossings, street crossings, sidewalks, etc., until it is known the way is clear. There are a great many personal injuries on account of not observing this rule.

11. Hand cars or motor cars should never be attached to a moving train—this practice is very dangerous.

12. Hand cars and motor cars should be kept at a safe and sufficient distance apart while moving to and from work, according to the rules. This is very important, as a great many personal injuries to trackmen result from this cause. When cars are stopped for any reason, a signal should be given to the cars following, and it should be known that the signal is understood before the car is stopped.

13. Hand cars and motor cars should not be run to exceed 15 miles per hour, and should be run through towns, yards, over road and street crossings, switches and crossovers at a safe speed.

14. Track foremen should carry proper flagging equipment, such as flags, torpedoes, etc., on hand and motor cars at all times, and be in position to do proper flagging.

15. When possible to do so, rails should be cut with a hack saw; when cut with a chisel men engaged should not stand on the same side of the rail. The man holding the chisel should be on one side and the man striking the chisel should be on the opposite side.

16. All men engaged in cutting rails with a chisel should wear non-glass goggles for the protection of their eyes.

17. There are a great many trackmen who are not experienced in the handling of ties and their distribution from cars. It is a good practice to have one foreman on each car that is being unloaded to instruct the men in the proper method and manner of handling ties. This practice has resulted in avoiding a great many personal injuries on my division.

18. Trackmen should not be allowed to unload ties from cars while the train is in motion. It is dangerous, and will result in personal injury to the men engaged in the work. Many railroads have adopted the plan of scattering the ties, making it necessary to unload them from moving trains; this, in my judgment, is improper and unsafe.

*Presented before the Railroad Section of the National Safety Council at its annual meeting in St. Louis, Mo., September 18, 1918.

19. Trackmen should not be allowed to ride on bottom-dump ballast cars while the train is in motion. They have been known to dump while the train was in motion, and, on account of dumping, men have been injured and killed. A case of this character occurred near Webb City, Mo., on the Missouri Pacific about one year ago.

20. In making long rides to the point of unloading, men should not be allowed to ride on ballast cars, neither should they be required to ride in tie cars until they reach the point where the work is to begin—it is unsafe.

21. One of the greatest of accident preventives is the proper supervision of track tools. Men should not be allowed to use battered head chisels, sledges, or spike mauls, badly worn-jawed claw bars, or track wrenches that are worn oval-jawed, permitting them to slip off the bolt nut. The track gang tools should be examined by the roadmaster at least once a month and all improper tools should be brought to the foreman's attention and turned in on the first store cars over the line.

22. Trackmen should not be allowed to use track jacks that are not in proper working order; this practice is very dangerous, and often results in personal injuries to the men using them.

23. Men in track gangs should not be allowed to work in bunches too close together, as men are often injured on this account by tools in co-laborers' hands. This applies also to the unloading of material from cars—men should be a sufficient distance apart to avoid personal injury to each other.

24. Trackmen should not be allowed to tighten bolts on high trestles by standing on the outer side of the rail. This has resulted in severe personal injuries, on account of wrenches slipping off the nuts and men falling to the ground. They should stand on the gage side of the rail while tightening bolts on trestles.

25. Trackmen should not be allowed to pull spikes from the outer side of the rail on trestles with claw bars. Spike pullers should be used in connection with claw bars, so that the work can be done by men standing inside of the rail.

26. Trackmen should not place track jacks on the inner side of the rail when surfacing or leveling up tracks. The track jack should be worked on the outside of the rail, thereby avoiding any chance for personal injury; in addition, this results in doing the work better, as track jacks placed on the inside of the rail invariably throw the track out of line.

27. We had a personal injury caused by bridgemen in constructing a pile trestle at the end of a span, driving spikes in the piling about two feet apart on each side, thereby making a ladder to climb from the ground to the deck. The bridge was about 25 ft. high. Two years afterward, when the piling had become thoroughly dry, the spikes became loose in the piling, and the track foreman, going from the ground to the deck, used these spikes to climb up by. When near the top one spike pulled out and he fell to the ground, breaking his arm.

28. We had an accident in which a car foreman was sent out to load a damaged pair of trucks by the use of skids. One axle and the truck frame were intact, and one pair of wheels was detached from the truck frame. The men loaded the truck frame and the axle which was attached, but in loading the pair of wheels the foreman instructed the men to load it by hand, which they did. When near the top of the car the wheels slewed, falling between the skids and injuring one of our best track foremen for life. This accident could have been avoided by attaching a rope to either end of the axle and placing four men on the car to prevent the axle from slewing. The accident was the result of an improper method of loading the wheels.

Training of Foremen in Safe Practices

During the period of the safety movement on the St. Louis-San Francisco I have made a study of accident prevention to trackmen and others. So far as trackmen are concerned, I find that it is a hard matter to secure success without the co-operation of every foreman handling track gangs. One of the most important things is to educate the foremen with reference to the different causes of personal injury to trackmen and to get them interested in the safety movement. When you have educated your foremen to instruct their men properly and to guard against unsafe practices and unsafe methods of doing work, personally instructing his men in what he is going to do and how he is going to do it, it is my opinion that personal injuries to trackmen, or a great percentage of them, can be avoided. The roadmaster must take an interest in his foremen and talk these matters over with them, and, in turn, the foreman must do likewise with his men; in this way the biggest percentage of injuries to trackmen can be overcome.

Each personal injury on my division is investigated thoroughly. I get all the data as to just how the accident happened and what, if anything, the foreman did to prevent it and write up the accident, covering every detail; I forward a copy to each foreman and have him advise me how the accident could have been prevented, and, in his opinion, what the cause of the accident was. In a great many cases it will be shown that it was by lack of proper handling by the foreman. After this information has all been filed the papers are sent to the foreman who had the accident, with a request that he be more careful in the future. We also instruct him how he should have handled the matter. I find that this works fine. Most of the foremen desire to do their work in a satisfactory manner and try to handle their men without loss through personal injury. By handling matters in this way a great many injuries are avoided and unsafe practices are discontinued.

OFFICIAL CITATION

Dilboy, George, Private, First Class, Company H, 103rd Infantry. (Deceased.)

FOR conspicuous gallantry and intrepidity above and beyond the call of duty in action with the enemy near Belleau, France, July 18, 1918.

After his platoon had gained its objective along a railroad embankment, Private Dilboy, accompanying his platoon leader to reconnoiter the ground beyond, was suddenly fired upon by an enemy machine gun from one hundred yards. *From a standing position on the railroad track, fully exposed to view, he opened fire at once,* but failing to silence the gun, rushed forward with his bayonet fixed, through a wheat field toward the gun emplacement, falling within twenty-five yards of the gun with his right leg nearly severed above the knee, and with several bullet holes in his body, with undaunted courage, he continued to fire into the emplacement from a prone position, killing two of the enemy and dispersing the rest of the crew.

Make good his sacrifice. Invest in *Victory Bonds* to the very limit of your cash and resources.

HAVE HIGHER WAGES INCREASED EFFICIENCY?

Restrictive Regulations Impede Full Utilization of Present Favorable Conditions

IF "MONEY TALKS," the high wages now being paid to employees in the maintenance of way department should be reflected in the increased efficiency of the labor. Two years ago track men were receiving 16 to 18 cents per hour and bridge carpenters or water service employees 25 to 30 cents. To-day track men are being paid 38 to 40 cents and bridge and water service employees 58 and 68 cents. To what extent are the roads benefiting from this added outlay? This is the question which three men in direct charge of maintenance work in the field attempt to answer in the discussions following.

For years it was the common practice of the roads to pay the lowest market price for track labor in general, and this resulted in the roads securing a poor class of men. Many maintenance officers have contended that if their roads would pay higher rates, these rates would attract a better class of men and that the increased efficiency of these men would more than compensate for the added expenditure. Within the past year the rates for maintenance of way labor have been raised greatly, until now they are, in general, equal to or above those prevailing for similar work in the adjacent communities, outside of the large industrial centers.

With a rate sufficient to permit employing officers to exercise some choice in the selection of their men, it is pertinent to inquire to what extent advantage is being taken of the situation to replace the inefficient men now enrolled with those more capable and thus secure a return for the increased expenditure, for it is self-evident that the payment of a higher wage to the same men will bring little or no results. Obviously, if the efficiency of the forces cannotbe made comparable with the added expenditure, this expenditure has not justified itself and railway officers will be warranted in returning to their former practice of paying only the market rate. However, a study of the conditions prevailing at present shows that this comparison is not a fair one at present, for with the authorization of the increased wages certain restrictions were placed upon the employment and discharge of men which have hampered officers in their efforts to improve the personnel of their forces and have largely and in many instances entirely eliminated the opportunities which would otherwise have been created.

In Article 1 of Supplement No. 8 to General Order No. 27, it is specified that in reducing forces seniority shall govern, and that when forces are increased employees will be returned to the service and positions formerly occupied in the order of their seniority. The discussions which follow emphasize the opportunities afforded by the present situation and also point out the practical difficulties preventing the roads from taking full advantage of them.

AN OPPORTUNITY TO IMPROVE PERSONNEL

By F. J. Meyer

Roadmaster, New York, Ontario & Western, Walton, N. Y.

The efficiency of any force of men depends almost entirely on three factors: personnel, organization and administration. The war with Germany clearly demonstrated that while organization and proper administration will work wonders, the problem of efficiency ultimately reverts to the time-honored truth that no organization is better than the individual members which compose it.

The first consideration in an effort to improve the personnel of maintenance of way forces should lie in the selection of the men who will compose the force. Not many years ago each man on a railroad hired the man or men who worked for him. This method had some advantages, but the fact that it has been generally discarded except in the maintenance of way department is fairly good evidence that the disadvantages outweighed the advantages. It is the writer's understanding that some lines have already adopted a system of formal application and investigation, for their maintenance of way forces.

True it is that until quite recently "catch as catch can" methods had to be used to induce men to enter the maintenance of way department. That was especially true of the track forces. The insufficient wages paid for this class of work until the time war was declared against Germany was the principal cause of this.

To-day the problem is entirely different, for the wages now being paid maintenance men permits careful selection. Sound business judgment dictates that great care be exercised in selecting men and Supplement 8 to General Order 27 requires a careful selection. The sooner maintenance officers take advantage of the fact that they have a larger field to select from than the towns where the section or gang headquarters are located, the quicker will the first step be taken toward the improvement of the maintenance personnel.

To-day our organizations are, generally speaking, composed of men selected by as many individuals as there are foremen. In some ways it may not be desirable to take away from the individual foreman the prerogative of selecting his own men, yet the selection should be systematically reviewed by the foreman's superior to whom the man can appeal in case of dismissal. Moreover, by broadening the field of employment, forces will be more nearly distributed where they are required.

Let us consider for a moment the importance of using great care in selecting men for any organization. It is the very foundation on which one builds. There are a few men, both in high and low places, who select for assistants lesser lights so their own personality will shine to greater advantage. That, however, is the policy of a dwarfed mind and is never found in highly successful organizations. The biggest men select the best material available. It is only on the basis of careful selection that material for master trackmen can be found.

Another important matter to be considered in improving the personnel of maintenance forces and most particularly in the track department savors somewhat of the radical, but may possibly be worth considering. Trackmen are paid higher wages than common labor in most communities and this in itself places them in the class of semi-skilled workers. If this is the case why not term the regular track workman a trackman instead of laborer? It is an honorable occupation in which a man does become proficient, even though he never becomes a foreman. The inexperienced man who only works occasionally on the track is quite a different type from the regular trackman and should be so considered and so paid. There is no really good reason to-day for paying the same rate for inexperienced men as is paid experienced. Besides, advancement appeals to the ambitious.

The careful selection of new men and a proper differential will automatically improve the personnel of the entire existing force. It will also demonstrate clearly that the trackman's position is one which can only be filled by

the most desirable and so will open the eyes of all workers to the fact that they are competing for advancement with the best the railroads can hire.

The careful selection of new material and a differential in wages between regular and occasional workers is only part of the problem. The foremen have repeatedly proven that they are the backbone of the existing organization in the maintenance of way department, for in the days of labor shortage on the railroads the foremen have certainly shown a wonderful ability. To keep these men at the highest efficiency a just differential should be maintained between them and all grades of railroad workers, not as a reward, but merely as just recompense, and keep them interested, enthusiastic and anxious for promotion. The leaders of men should be ambitious and enthusiastic, for enthusiasm is contagious. Recruits properly selected and led by enthusiastic foremen will greatly improve the personnel of the maintenance forces.

PERSONAL APPEAL WILL HELP

BY SUPERVISOR

The present conditions certainly make most timely the discussion of methods by which the efficiency of railway labor may be increased. As I see the problem, it is not a question of increasing the efficiency of the men in proportion to the increase in wages, but rather that of restoring the efficiency of the men under the increased rate to that of former years under the low wage in certain branches of the maintenance of way department. Many employees who were getting 30 cents per hour two years ago are now receiving 68 cents per hour, while their present efficiency will not exceed 60 per cent of that of former years. This means that, taking into consideration the loss of efficiency and the increased wage, the increased cost of labor has been over 200 per cent. As an example, a recent investigation showed that a certain type of railway structure that could be erected in three weeks' time under normal conditions now takes five weeks for erection with the same number of men. While this may appear to be an exaggerated case, and may not apply to railway work in general, it is an example taken from actual observtion and is by no means an unusual condition where the forces consist of skilled labor.

The unswerving loyalty, industry and morale of our maintenance of way forces has in former years been a matter of pride to all officers in this branch of the service and they have lost no opportunity of praising this body of men, and in calling attention to the fact that the fidelity and loyalty of these men to the railroads was something that money could not purchase. There is no denying the fact that the efficiency of these men has greatly decreased. Before attempting to apply a remedy for the present labor conditions it will be necessary to study the causes of what may be called for lack of a better term "the decreased morale of the maintenance of way forces."

The uncertainty and delay in fixing and awarding the wage increases to be applied to the maintenance of way forces undoubtedly was a large factor in decreasing efficiency and has done much towards creating the existing situation. Had these forces been given prompt consideration in applying the wage increases there is no doubt that it would have done much towards preserving, if not increasing, the efficiency of the class as a whole.

Another objectionable feature in connection with the wage award was the ruling in regard to seniority rights, particularly as applying to the reduction of forces. In applying this rule the hands of the supervisory forces are tied so far as recognizing merit and ability among the men, and this does not tend to encourage initiative of men. A man of mediocre ability, if long in the service, has a decided advantage over a first class workman with a shorter term of service.

Another element that has its effect is the "Work or Fight" order, which has brought an element of labor into the maintenance of way forces that, to say the least, did not tend to increase the efficiency or morale. This feature was more apparent during the great labor shortage than at the present time, and this undesirable type of employee will now be weeded out automatically. In many cases the discrepancy in pay between the maintenance forces and those in other departments has been exaggerated by the men, or else viewed in a false light, as they have not always taken into consideration the varying conditions of service in the different departments, as well as in different parts of the country, which features were rightly given consideration by the Wage Board.

It would be the height of inconsistency for one to suggest remedies which were untried or to present a discussion, or recommendation, for the solution of a problem that one has not figured out to his own satisfaction, and to offer any suggestion that would be an experiment, which might not work out satisfactorily.

The first means of reducing expenses which presents itself to the average officer is the reduction of force, as the result of such action shows immediate results in lessened expenditures. However, such action should receive careful consideration, as too often the first thought is the reduction of the supervisory force, which has never been too plentiful on our railroads. It is often the case that, in reducing forces, a high priced man is cut off and two lower priced men employed at a decreased efficiency and increased pay roll.

Personal appeal to the men through the maintenance officers coming in direct contact with the men will probably do more towards securing quick results in increased efficiency than anything else. In this way many a fancied grievance may be readily dispelled and a dissatisfied, grouchy time-server changed into a satisfied, industrious employee. Each employee is equivalent to an investment of many thousands of dollars, the wages representing the interest on this investment, and unless the labor of the employee shows a profit on the investment he is carried at a loss. Our maintenance of way employees, as a whole, are an intelligent class of men and an appeal to their intelligence will undoubtedly bear fruit in increased effort and efficiency.

SOME OF THE PRESENT HANDICAPS

BY BRIDGE SUPERVISOR

I must disagree with the statement that the wages of maintenance of way forces have been raised equal to or above those of men employed in similar work in most of the communities. This is not true of the section of the country in which I am located. My bridge and carpenter men receive 56 cents per hour for an eight-hour day, while men of like ability are receiving from 65 cents to 75 cents per hour in shipbuilding plants, and for other work where my men would be considered first class mechanics. Yet the increases which we have received have attracted a great many good men, and owing to the fact that many plants which have been working on government work have shut down it would be possible for us to secure our pick of the very best men to be had. Personally, I have been obliged to turn away many of the very best mechanics, men who are not only skilled in their craft, but also have a good knowledge of railroad work.

What can we do to improve the personnel of our forces? We are tied hand and foot. With the increases in wages for our men came certain orders and regula-

tions which required us, in the event of a reduction of forces, invariably to let the man go with the shortest record of service, regardless of his efficiency, a consideration which does not seem to enter into the case at all. To illustrate my point, I have reduced one crew during the past winter by about 5 men. This was a carpenter bridge crew, and should be composed of men who are able to do any sort of heavy carpenter work, using the broad axe, the adz and such tools freely. The facts are that the only man in this crew who could use a broad axe or adz to any extent whatever was one of the younger men, whom, under the ruling, I was obliged to discharge. You will wonder that a crew of 20 men should only have one man in it who was thus qualified, but this was because of the fact that for the last three or four years our best men have left us to go into higher paid service and we have been obliged to hire what men we could get, which, in most cases, has been very poor material. I have been fortunate in securing some very excellent men within the last year, but should I be forced to reduce my forces further I would have to let go the very best men I have.

We shall never be on an equal footing with contractors until we are (1) allowed to pay our best men a rate nearly equal to that which the contractor pays, and (2) are able, when reducing forces, to let our poorest men go and keep our best regardless of their term of service. I do not mean by this that we should let go a man who has been twenty years or more with us because other men have become very efficient, but we should be allowed to let men of from two to five years' service go, even though we keep a man who has not more than six months' service in their place, provided that the men with the six months' service are the most efficient.

We should also be allowed to rate our men according to their efficiency and fitness. A man who takes little or no interest in his work, does not try to do his best and has no ambition should not be rated equally with the one who is constantly seeking to do all that he can in the best manner possible.

Another feature that has militated against our improvement of service has been the failure to increase the wages of our foremen properly. This may be a local trouble, but, as an example, I have one foreman who receives 64½ cents per hour for eight hours' work, while his assistant receives 78 cents per hour for the same time, his gang leader receives 73 cents per hour, his mechanics 68 cents per hour and his helpers 45 cents per hour. You will readily see that this is not conducive to good discipline or efficient service, especially as this condition has existed for several months without any immediate prospects of improvement. In fact, all of our supervisory forces are greatly underpaid in comparison with the men whom they supervise. This applies not only to foremen, but to higher officers as well.

Pedestal Track Construction in Holland

THE USE OF reinforced concrete pedestals supporting the rails, with tie bars to maintain the gage is receiving considerable attention in foreign countries. Among others the East Indian Railway has been conducting experiments wtih this type of construction for the last four years with varying degrees of success. In an article in Engineering (London), of February 22,

Fig. 1. Light Wooden Tie Supported on Wedges

1918, 11 ties installed in the Shalimar branch on January 25, 1914, are reported to have given satisfactory service, although other ties of the same design installed in a yard track one month later failed within a few weeks. Other installations have been made since that time and in a report made in 1917 the senior government inspector of railways at Calcutta, reported that the ties are standing up well and that "when the first cost and probable life are taken into account, it looks as if these ties would drive wooden and metal ties out of the market."

The pedestal form of track construction has also been used in Holland with the results described below.

EXPERIMENTAL TRACK CONSTRUCTION

By K. den Tex
Utrecht, Netherlands

A form of experimental track construction consisting of concrete pedestals under the rails, supporting steel ties of channel section which was installed in the Netherlands State Railways in December, 1914, was described

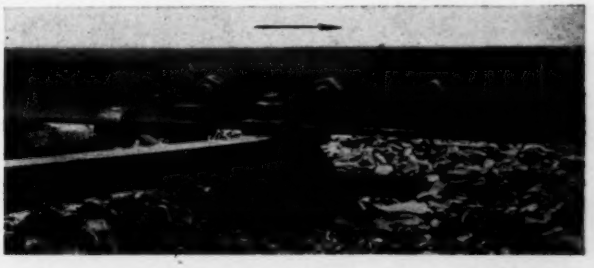


Fig. 2. Position of the Tie Under the Rail

in the *Railway Maintenance Engineer* for October, 1916, page 307. The concrete was protected from the shocks of the traffic by two hardwood wedges with an inclination of one in ten, placed between the pedestal and the ties. The pedestals and ties are spaced four feet apart, except at the joints where a two-foot spacing is maintained. Since the date of the original article these ties (30 in number) have continued to give satisfactory service. As it was thought that the conditions of this first trial were not severe enough, 27 of these ties were taken out and relaid in the same line near the station of Loenen-Vreeland, where express trains run full speed. The three remaining ties were left in place.

All the ties are laid at the joints. Fig. 2 indicates their

position under one of the rail-ends. The trains run from left to right, so the rail-end which receives the direct blows of the passing wheels is not supported.

Although two ordinary ones were taken out for each experimental tie installed, the surface of the joint can now be maintained better than before. Although they have been in use for over three years, the pedestals are as good as when they were new. The wooden wedges also are in good condition. They are not secured in place in any particular way, and yet their position is not altered by the shocks and strains of traffic.

In addition to this experiment, dating from 1914, other experiments have been made in order to obtain a lighter pedestal and a simpler mode of attachment. In 1915 a light wooden tie was installed, supported by two pedestals and single wooden wedges. (Fig. 1.) A total of 50 of these ties were laid, again at the rail-joints. The rails were 10 years old and had suffered in consequence, especially at the ends, so the conditions of this trial are even more severe than of the 1914 one. These pedestals did not behave nearly as well as those of 1914. About half the number had to be taken out, as their bearing surface crumbled away. In my opinion this was chiefly due to the pressure of the wedge on the concrete near the edge, as the cracks were first observed at this point. The lesson taught is illustrated in Fig. 3.

In 1917 another experiment was made with a very light steel tie of channel section, 2 in. high, supported on round slabs and single wedges, driven in the direction of the rails (Fig. 4). The bolts for attachment are hooked with their T-shaped heads in ears of round iron projecting from the slab. With this type an important reduction of weight and cost has been obtained. The weight of a slab is about the same as that of an ordinary tie. The reinforcing bars in the round slab can be arranged in the same way as those in the mushroom type of floor construction, and can be of comparatively light dimensions.

For these several types, the broken pedestals of the 1915 type excepted, the only work of maintenance which has proved necessary has been surfacing. The track needs some attention in the beginning, but the gravel under the pedestals is soon packed to the point where it gives an excellent support, owing to the large base. The rail-surface can be regulated by loosening the bolts and arranging the wedge, or by lifting the track with the jack and shoving some gravel under the pedestals. Both ways are easy, compared with the tamping of ordinary ties.

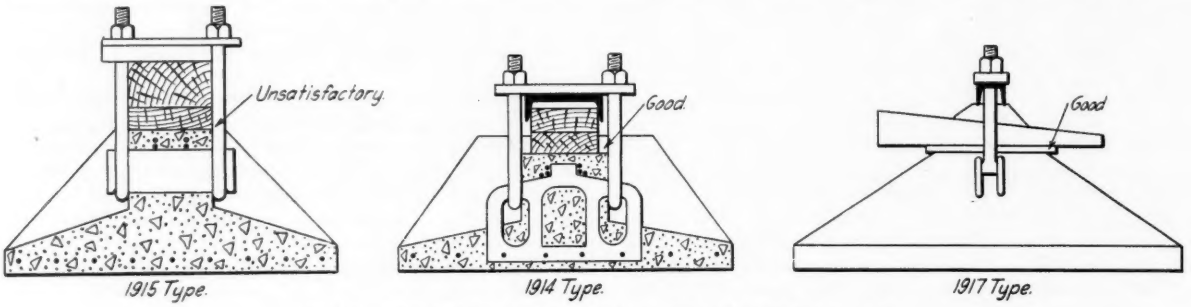


Fig. 3. Three Stages in the Development of the Rail Support

Fig. 4. A Later Type of Support

AN IMPROVED SPREADER

IMPROVEMENTS which permit the removal of from 85 to 90 per cent of the material dumped between the rails or the leaving of a cone-shaped section about 20 in. on top extending 4½ in. above the top of rails, between the rails for track raising purposes, have recently been made in the Mann-McCann KA1 type spreader. This spreader is also adaptable for ditching in cuts, its ballast carrying wings being utilized to collect material scattered by the ditcher in such a manner as to permit it to be picked up readily by the ditcher shovel and loaded into the cars.

The Spreader in Use in Cuba

The use of this machine is attended by the saving of one car in train equipment. As may be seen in one of the photographs it is located in the train where it is needed to do the work and may be operated by the fireman of the ditcher under the direction of the engineer. Because of its location it can be put into service at the most advantageous time without delays incident to the digging out of rails covered with dumped material. With this type of spreader there is no occasion for employing dump crews and, it is estimated, that its use saves at least one hour's time daily for the train crews. This spreader is manufactured by the Mann-McCann Co. of Chicago.

LEGAL DECISIONS ON THE USE OF TORPEDOES

Few Trackmen Realize What the Placing of This Device on the Track May Mean in a Court Decision

BY CHESLA C. SHERLOCK,

Attorney and Counsellor, Des Moines, Iowa

AT COMMON LAW it was the duty of the employer to furnish the workman with a reasonably safe place in which to work and with reasonably safe tools and appliances. If there were any dangers attending the workman in the pursuit of his duties, which were known to the employer by reason of his advantages for superior knowledge, it was his duty to warn and instruct the workman against those dangers.

The doctrine of assumption of risk served to relieve the master from liability from injury only when the danger causing the injury was apparent to all, or especially known to the workman, so that he proceeded with full knowledge of it in such a way as to be held to have assumed the risk of his acts. The doctrine of the fellow-servant rule was that the master could not be liable for the negligence of a fellow servant which caused the injury complained of, as one man cannot be charged with the acts or negligence of another, unless he ratifies them or unless they are due to the nature of the work. The doctrine of contributory negligence was that if a man is injured partly through his own fault he cannot expect to recover for his injury entirely from another.

A track laborer or other employee may be employed upon a railroad and be in a reasonably safe place in which to work, but the placing of a torpedo upon the track will operate to change the character of the place so that under certain circumstances it is not a reasonably safe place in which to work.

If this is true, then the employing company will be liable for the injury done, but that is not the only liability attaching to the employer. He has, by changing the character of the place in which the workman is required to perform his duties, incurred the obligation of instructing and warning the said workman of the increased hazard of his place of work. If the employer fails to so warn his workmen then he is liable in damages; but if the employer does warn his workman of the danger he may be relieved of liability, depending upon the manner in which the injury occurred. If the workman has been warned as to the presence of torpedoes upon the track in a certain area and he proceeds carelessly with his car, running over them and causing them to explode and injure him, he would doubtless be held guilty of contributory negligence and would be unable to recover.

But there are many possibilities even where he has been warned of the danger of his being injured in such a way as to hold the employer liable for the damage done. An employer or his representative may warn the workman of the presence of torpedoes in a certain locality and say nothing about them in another place. The workman may proceed cautiously in the stated locality and receive no injury and then proceed over the other territory and be injured. I think the chances would be favorable to the workman in such a case. The same liability may attach to the employer where he leads the workman to believe by inference that the torpedoes are only in a certain locality, and that the track elsewhere is free of them.

In an Indiana case (1914) a track laborer was injured by pushing a car over a track where a torpedo had been placed by the employer or his representatives. The metal part of the torpedo was driven into the plaintiff's leg by the explosion, causing severe injury and greatly lacerating the leg. The plaintiff claimed that his employer had failed to furnish him a safe place in which to work by reason of his failure to instruct him that torpedoes had been placed upon the track or to warn him as to the dangers of their explosion. He stated that he had no knowledge whatever of torpedoes, that he did not know they were upon the track or that they had been used in that vicinity, and that it was not a part of his duty to discover obstructions on the track and remove them; that he was suffering from defective eyesight and could not see small objects more than five feet away from him and that, therefore, he had no means of discovering the torpedo before he pushed his car upon it.

The court held that there could be no presumption that the torpedo had been placed upon the track by a fellow-servant; that the mere fact that it had not been negligently placed there in the first instance did not necessarily follow that it was not negligence to allow it to remain there, and that since the plaintiff had stated that it was not a part of his duty to examine the track and keep it free from obstructions and that by reason of his defective eyesight he could not discover such objects in time to prevent them exploding, such allegations negatived the assumption of risk, and that where the employer creates a dangerous situation, it is the latter's duty to warn the servant, otherwise such a failure will render him liable.

In a Kentucky case (1907) a section gang was proceeding along a track to its place of work, under the direction of a foreman. Upon the approach of a train, the men took their car off the track and in so doing disabled it so that it would not work, making it necessary for them to push it. While so engaged, they heard a train approaching and the foreman directed his men to hurry to a place where they could remove the car and allow the train to pass. The plaintiff was running along, helping push the car, when it hit a torpedo which had not yet served its purpose. The explosion caused a part of the torpedo to enter the plaintiff's leg, causing the injury.

The court ruled that the risk of injury from the explosion of a signal torpedo must be held to have been assumed by the plaintiff, as it was a risk incident to the operation of a railroad, and that he was guilty of con-

tributory negligence by failing to discover the torpedo, as it was a part of his duty as well as that of other members of the section crew to discover obstructions upon the track and remove them, and that the act of the company in placing a torpedo upon the track for a proper purpose, which had not yet been served, was not negligent.

In a Texas case (1907) it was shown that a freight train had been standing on a track for the greater part of one day loading cattle and that in such cases the rules of the company required that a flagman should go back a sufficient distance behind the train and place torpedoes upon the track in order to insure safety from other trains and that it was the duty of such flagman to remain near the torpedoes until recalled to the train, this being when the train was ready to proceed again. As soon as the freight had stopped, the conductor went back and placed two torpedoes upon the track, after which he returned to his work.

The plaintiff was a section foreman and he was proceeding along the track, examining it on his car. When he saw the freight standing at the station he had watched the track for torpedoes, but seeing no flagman near, concluded there were none on the track and continued to move his car, watching the banks of the roadbed, as considerable trouble had been experienced with high water.

His legs were hanging over the side of the car when he ran over the torpedoes and received the injuries complained of. He stated that if the flagman had been called in he would have heard the whistle, and would have known torpedoes were on the track; that the flagman was not on the track nor going towards the train; that if the flagman had been there as the rules required the plaintiff would have seen him and been on the lookout for torpedoes and would not have received the injuries; that if no train had been in sight that he would have continued to look for torpedoes until nearer the station. It was further shown that the rules required the flagman to stay near the torpedoes and that in case they failed to explode it was his duty to flag the incoming train to stop it to prevent injury to his own train, and that it was not customary to call in the flagman until the train was ready to proceed. The lower court had directed a verdict for the defendant company, but the supreme court held that the verdict should not have been directed in favor of the company and reversed it and sent the case back.

In the subsequent trial (1908) the plaintiff recovered a verdict of $14,000 and such verdict was sustained, the court holding that the company had not exerted the proper means of protection against the torpedo—a dangerous explosive. It was further held that the plaintiff had a right to assume that the employees on the train were acting in accordance with the rules of the company, and that since he had been misled by their failure to so act that he was entitled to recover for such damage as their failure to perform their duty had brought upon him. Since it had been necessary to amputate his leg, the court did not deem the recovery excessive.

In a Michigan case (1905) a workman was repairing a car and threw down a wrench upon the body thereof, which exploded a torpedo lying there, causing the damage complained of. The plaintiff testified that he recognized the torpedo as such, but that he did not know how it came to be on the car he was repairing. The court held that the court had erred in failing to direct the verdict for the defendant company.

In a Texas case (1915) the plaintiff was employed as a gardener about the station of the defendant company and it was his duty to gather up rubbish and burn it in the furnace or stoves in the station. While so engaged at various times he had found torpedoes in the rubbish and had called the attention of his superior to them. At the time of the injury he testified that he did not know whether there were two torpedoes in the rubbish or not, and that he was putting the rubbish into a stove with a shovel when his superior came along and took the shovel away from him, directing him to put the material into the stove with his hands. While putting in an armful with his face close to the door, he claimed to have heard a slight noise like "chooh" and that a flame shot out into his face and eyes, badly burning them.

Others about testified that they saw the flame shoot out of the stove, but that they did not hear any noise. It was further brought out that there was no evidence that the employees had at any time put torpedoes in the rubbish and that the company kept them under lock and key 200 ft. away.

Said the court: "If we give full credence to the statement of the plaintiff that he found torpedoes and told his superior about it, he likewise says that he knew that they were dangerous, and so refused to obey orders by throwing them into the fire. He was in a better position to know what was in the trash than anyone else, for it was his business to gather it up and burn it or put it in the place provided. If he did not know that such things were in the trash, that he was expected to burn them, and did not quit, but went ahead with the same work, after, as he says, his superior told him it was the order of the 'big boss' that he burn them, it looks like he assumed the risk.

"Facts may be established by circumstantial evidence, it is true, but where such testimony is relied on it should be much more cogent than that contained in this record. . . . But plaintiff invokes the doctrine symbolized by the maxim, *res ipsa loquitur*, which we understand means that the thing speaks for itself, or is a short way of saying that the circumstances attendant upon an accident are, of themselves, of such a character as to justify a jury in inferring negligence as a cause of the accident. . . . If it were proved that there was a torpedo in the furnace, it would still be necessary to show that the negligence of the defendant's employees caused it to be there. It occurs to us that the evidence is totally insufficient to support the judgment." At another time, in considering this same case, the court said: "Negligence of the master must be proved by direct or circumstantial evidence." And the court also held that "it could not go to the extent of holding that a gardener employed by a railroad company engaged in interstate commerce, to cultivate the yard about one of its stations, and gather trash and burn it, is engaged in interstate commerce. The state law is applicable under the facts in this case."

In another Kentucky case, decided in 1915, it was held that it was not negligence *per se* for a railroad company to place a signal torpedo upon a track, and that if the section foreman was guilty of gross negligence in failing to discover a torpedo upon a track over which he is proceeding with his crew on a car, that a workman injured by the explosion of such torpedo is entitled to recover damages for said injury. It was also held that the rules applicable to the handling, storage and care of explosives does not apply to the case of signal torpedoes, when placed upon the track for signaling purposes.

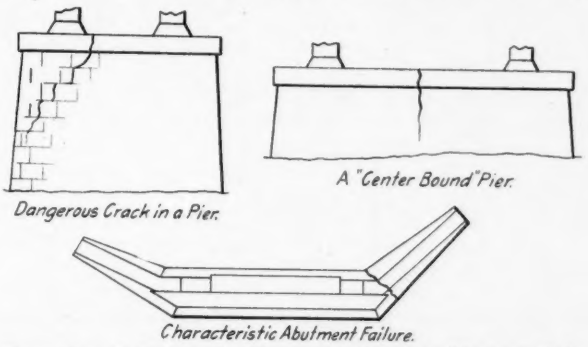
It was also held to be a proper instruction to say that the company was not negligent in placing the torpedo on the track, that the danger therefrom was one of the risks ordinarily incident to the plaintiff's employment, that he assumed all the risks ordinarily incident thereto, and that, unless the section foreman was guilty of gross negligence in failing to observe torpedo, plaintiff could not recover.

STUDYING THE DEFECTS IN MASONRY STRUCTURES

Considerations Affecting the Decision as to What Objectionable Conditions Require Correction

THE INSPECTOR OF MASONRY is brought in contact with a variety of structures—from stone piers and dry rubble walls to reinforced concrete girder spans. He is also required to pass upon a wide diversity of conditions—from dangerous undermining to minor surface defects. Some of the conditions encountered demand immediate remedy or at least some temporary protection to traffic until repairs may be undertaken. Others, while formidable in appearance, may be neglected for years without any serious consequence save a possible shortening of the ultimate life of the structure. It is in passing on this wide range of conditions that the inspector is called upon to exercise a degree of judgment only developed through experience and by contact with others having a wide knowledge of this class of work.

The inspection of masonry ordinarily does not permit of a very definite outline of procedure other than an examination that covers every visible detail so that nothing may be overlooked. For this reason the subject is better approached as a discussion of defects from the standpoint of various basic causes. The defects may be classified as those resulting from instability, overstress, mechanical wear, disintegration and weathering. Instability and overstress are in a sense the results of one class of conditions, i. e., they may be the result of overloading, improper designing, poor workmanship, and in the case of defects in a footing, instability may be the result of disintegration, that is, decay of a timber grillage or, in remote cases, the pile foundation. Instability and overstress differ in that the former refers to a failure of the pier or abutment to retain its original position, while overstress concerns its failure to carry the loads of traffic without rupture of some part and is evidenced by cracks in the concrete or stone masonry, although in the latter it may involve merely an opening of joints.



Examples of Defects in Stone and Concrete Masonry Substructures

Instability in a bridge substructure is a condition rarely seen first by the inspector. The track and carpenter forces will note any settlement in looking after the alinement of the track across the bridge, while serious undermining at the time of a flood or washout will be watched for by those on the ground. However, in important river bridges, guarding against undermining consists in seeing that it has no opportunity to take place, i. e., inspection consists in taking the necessary soundings to insure that there is enough riprap around the piles to insure safety. Unless undermining is possible or the foundation material is extremely soft, settlement is not usually a serious matter except in so far as it results in distortion of the superstructure. Where the latter consists of steel girders or trusses, shimming up the bearings will serve. The same is true of concrete slabs or girders, although the chance for damage to the spans is greater. It is in the arch bridge—whether of steel, stone or concrete—or superstructures continuous over several supports that settlements even of small degree are serious and require immediate attention.

Overstress

Stone masonry piers that are overloaded, poorly designed or improperly built tend to develop cracks that may be of such a nature as to threaten the safety of the bridge seriously. These cracks are progressive and result in part from a process of shaking or racking of the pier under traffic. Sometimes the end of the pier carrying one of the bearings tends to shear away from the body of the pier, a condition indicated by a diagonal crack extending from the coping inside of the bearing to some point on the end of the pier near the bottom. If this condition has progressed to any extent the pier must be banded.

If the pier is long and rather low it may fail as a transverse girder. Thus a stone masonry pier with the load mostly in the center may develop an appreciable sag at the center with the ends cocked up. Other piers with the bearing shoes very close to the ends may break in the middle like a centerbound track tie. Where conditions are serious, the inspector should recommend the extension of the footings to correct the unequal loading.

Abutments are subject to the same troubles as piers and also to several that are peculiar to abutments. On wing abutments wings set at a sharp angle with the body have a tendency to break away from the central portion at the corners. The inspector should record this condition, but ordinarily there is nothing to be done, for while this condition is unsightly it usually offers so remote a possibility of serious trouble that the expense of any practicable form of repair is not warranted.

Backwalls on old abutments are sometimes improperly proportioned with the result that they are not strong enough as retaining walls and lean forward, crowding the span. Usually the only indication of this in a stone masonry abutment is that the masonry is closer to the steel work near the top than at the bottom. If there is any danger that the backwall will bear against the steel, something should be done to support the backwall. In some cases, it may be possible to put in buttresses.

Bridge Seats

The bridge seats of both abutments and piers often disclose objectionable conditions in the form of cracked or shattered bearings. This is more common in stone masonry and may result from either or both of two defective conditions: (1) a weak bearing stone, (2) faulty construction underneath. If the stone is badly shattered it was probably too weak to withstand the bearing pressure and vibration from the superstructure. If there are simply one or two cracks in it, particularly cracks lengthwise of the pier, the trouble is probably poor support underneath. Formerly stone piers were often built with a layer of good substantial masonry around the outside and a backing of what was little more than stone rub-

bish, so that the bearing stones are adequately supported at the sides, but not in the center because of the inferior material in the interior of the pier which settles and grinds up under load. Evidence of this last condition has been noted occasionally by a flow of mud or stone silt from anchor bolt holes under the pumping action produced by the passage of a train. It is needless to say that this was an extreme case. The inspector's recommendation for correction of broken bridge seats will depend upon the severity of conditions and will vary from the replacement of the bearing stone to the reconstruction of several courses of stone below the coping. Concrete blocks, either plain or reinforced, are often used to replace stone, and grillages of creosoted timbers has also been used with excellent results.

Arch bridges, as a rule, have been built so conservatively that they do not often suffer from damage due to overstress in the arch ring. Sometimes settlement may produce serious consequences and cracks in the arch ring or ribs, evidencing troubles of this kind which should be watched closely. Wing walls are subject to the same defect as those on bridge abutments. Cases have also been noted where spandrel walls have bulged, tipped or slid on the arch ring under the pressure of the spandrel filling as a consequence of poor design. The inspection of an arch bridge should include a check on the condition of the spandrel walls.

REINFORCED CONCRETE

The wide use of reinforced concrete during the last 15 years or more has introduced new problems for the inspector. Defects discovered in these structures are usually the results of faults in minor details of some of the early designs, such as inadequate provision for contraction. For this reason, the bearings of trestle slabs or girders should be examined carefully for a tendency of the bearing portion of either the slab or the pier to break away from the body of the structure. The tops of slender piers with inadequate reinforcement in the bearing face have been known to split down the middle as though the two slabs were tending to pull the pier apart. On the whole these defects usually look much worse than they actually are.

Mechanical wear is a condition of bridge seats occasionally encountered. It results from the pounding of the end bearings of stringers or short beam spans and has the effect of depressing the bearing shoe into the masonry. This does not represent a dangerous condition, the remedy being to introduce shims and if possible to correct the fault in the superstructure that results in the pounding.

DISINTEGRATION

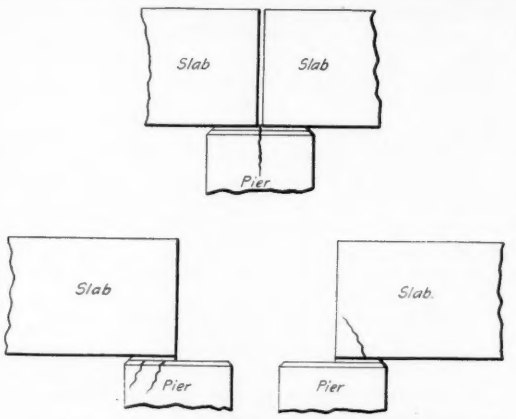
Disintegration and weathering are allied effects and may properly be considered together. They cover the slow destruction of the masonry through influence of time or weather under propitious circumstances of poor material, poor workmanship or both. In stone masonry, the most common and least objectionable condition encountered is open joints between the stones through disappearance of the mortar near the surface. It should not be confused with open joints caused by the racking of the structure from overload. The cure for open joints from material causes is simple—repointing.

Weathering of stone work is another common condition, characterized in the early stages by examination followed by spalling, a progressive process under which the stone gradually wastes away. This is simply a case of poor material. An inspector thoroughly familiar with the masonry work of a given region can readily identify the quarries from which the stone in the various structures came by the manner and degree of weathering. This condition may be produced artificially or aggravated by the presence of water. The intrados of a leaky arch ring will be found to waste away if the stone is constantly saturated with water owing to improper drainage. It is generally assumed that the frost is an important influence in this connection.

In concrete work poor materials and poor workmanship in the making of the concrete are occasionally manifested, more often in the older work than in that built since the preparation of materials and rules for workmanship have reached their present development. Evidences of poor cement or natural cement used in exposed places, frozen concrete, dirty or soft aggregates, are not often seen in the newer structures. On the other hand, faulty design or workmanship are still evidenced more often than they should be by inadequate drainage, poor spading, leaky forms, etc.

Most of the conditions of disintegration described above require ultimate correction, which in most cases will be extremely expensive. But, fortunately, the date when such repairs must be made is very remote. The problem of the inspector, therefore, is to differentiate between the conditions requiring immediate attention and those not of a pressing nature.

Water leaking from the construction joint of a concrete arch may cause an unsightly discoloration, and an

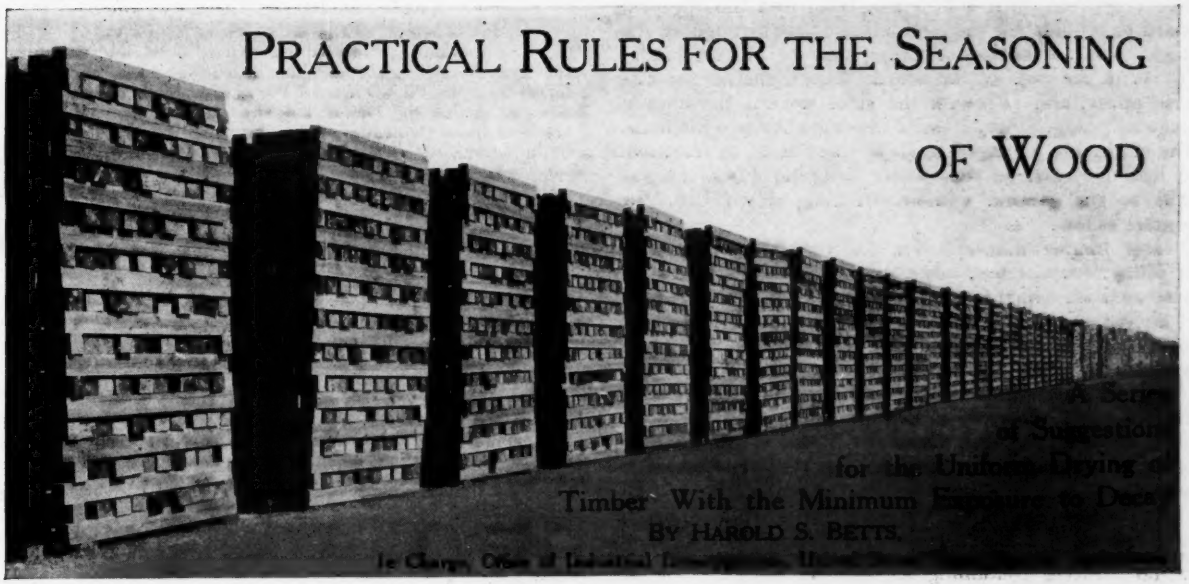


Types of Cracks Formed Occasionally in Concrete Trestle Construction

accumulation of efflorescence and even some spalling of the concrete where the water emerges. It is a condition to be regarded with apprehension and should be watched closely, but ordinarily it does not become much worse from year to year. At the same time, the cost of stopping the leakage may involve the removal of the entire spandrel filling and entail so great an expense as to be prohibitive until the defect is such as actually to endanger the bridge.

One other defect in masonry having to do with disintegration is that resulting from the decay of the grillage or piling upon which the structure is supported. Whereever any of the timber work is above the low water line so that it is subject to decay, a point should be made of visiting the bridge at times of low water so that any exposed timber may be examined. This will work where the grillage extends above the ground. Where buried, it cannot be examined and will not be suspected of deterioration unless there is some evidence of settlement or cracks in the masonry. Cases of failure from this cause are rarely encountered, but piles have been known to rot off completely in intermittently dry ground, the soil taking all the load, such discoveries being made in replacing old structures.

PRACTICAL RULES FOR THE SEASONING OF WOOD



A Series of Suggestions for the Uniform Drying of Timber With the Minimum Exposure to Decay

BY HAROLD S. BETTS,

In Charge, Office of [illegible]

PRACTICALLY all wood is either seasoned in the air or dried in a kiln before being put to use. The main objects of seasoning are to increase the durability of the wood in service, to prevent it from shrinking and checking, to increase it strength and stiffness, to prevent it from staining, and to decrease its weight. The sooner wood is seasoned after being cut the less is the chance that it will be injured by the insects which attack unseasoned wood, or by decay before the time comes to use it. In nearly all cases wood that is to be treated with preservatives needs to be seasoned as much as wood that is to be used in the natural state.

Wood has a complicated structure. The walls of the cells of which it is made up shrink and harden when moisture is removed from them, and unless timber that is to be air-seasoned is piled in the right way, or conditions in the dry kiln are maintained in accordance with certain well-defined physical laws, the material is likely to warp or check, or in some way to be damaged seriously. Until recently proper methods of seasoning received comparatively little attention and large losses were the rule, especially among woods that are difficult to dry. Sometimes as much as 20 or 25 per cent of the seasoned lumber was rendered unfit for the use intended by defects which had their origin in the drying process.

Water exists in wood in two conditions: (*a*) as free water contained in the cell cavities, and (*b*) as water absorbed in the cell walls. When wood contains just enough water to saturate the cell walls, it is said to be at the fiber saturation point. Any water in excess of this which the wood may contain is in the form of free water in the cell cavities. Removal of the free water has no apparent effect upon the properties of the wood except to reduce its weight, but as soon as any of the absorbed water is removed the wood begins to shrink. Since the free water is the first to be removed, shrinkage does not begin, as a general rule, until the fiber saturation point is reached. For most woods this point corresponds with a moisture content of from 25 to 30 per cent of the dry weight of the wood.

Shrinkage is due to the contraction of the cell walls, and sets up stresses which tend to cause the wood to check. As observed in a cross-section of a piece of lumber, shrinkage in the tangential direction is about twice as great as in the radial direction; lengthwise of the lumber it is very slight.

How Wood May Be Injured in Seasoning.

Checking is caused by unequal shrinkage. If the outside of a piece of wood dries considerably faster than the inside, the surface in time will contract until it can no longer extend around the comparatively wet interior, and so will be torn apart in checks. Checks often are classified as end checks and face checks. End checking or splitting during seasoning causes nearly as much loss as face checking.

Casehardening or surface hardening occurs when the surface of wood becomes set in a partially dry condition while the interior is still wet. This condition results from too rapid surface drying. If the interior of a casehardened piece of wood dries further, it tends to shrink, while the "set" condition of the surface tends to prevent it from doing so.

Honeycombing or internal checking occurs in casehardened pieces when the interior continues to dry and the surface remains fixed. In such cases splits appear in the interior.

Warping or twisting in lumber is due to unequal shrinkage. Some woods are much more subject to warping than others. The trouble can be prevented to some extent by careful piling, both during drying and afterward.

In some woods, notably western red cedar and redwood, when the very wet wood is dried at a high temperature, depressions appear on the surface of the boards, presumably due to the collapse of the plastic cell walls in certain places. If, however, the woods in question are heated above the boiling point while wet, the steam generated in the non-porous cells causes the wood to bulge on the surface.

Air-Seasoning.

Sawed lumber generally is dried by being piled in stacks with air spaces between the boards. In forming the stacks the boards usually are laid flat, with strips called stickers between courses or layers. A space also

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is left between each board in a layer and the adjacent board to provide for the circulation of air throughout the stack. Flat or horizontal piling may be of two kinds: (*a*) With the ends of the boards toward the alley—endwise piling, and (*b*) with the sides toward the alley—sidewise piling. Figs. 1 and 2 illustrate the two methods. The stacks are arranged to slope from front to rear, and to lean forward so that water dripping from the top falls to the ground without trickling down over the courses below.

Most lumber maufacturers use the endwise method of piling. A number, however, have adopted the sidewise method, which has certain advantages in the matter of air circulation. In endwise piling the stickers obstruct the passage of air from back to front of a course, while in sidewise piling the passages from front to rear are clear. Water which forces its way into the pile is drained more efficiently in sidewise piling, and the likelihood of sticker rot and discoloration due to the accumulation of moisture, dust and dirt against the stickers is lessened.

The bottom boards in a stack rest on skids, which in turn rest on foundations, preferably of stone, cement or metal. Pieces containing rot should never be used for foundation timbers or skids, or allowed to remain in the pile.

Lumber-storage yards need to be reasonably well drained, or at least the contour of the ground should be such that water will not stand under the stacks after a storm. Otherwise decay is apt to get a start and spread throughout the pile. Where the ground offers but poor

Fig. 3. Sloping the Ground Surface Under Lumber Piles

natural drainage facilities, some artificial system of drainage usually is employed. Fig. 3 shows an arrangement which not only prevents the collection of rain water under the lumber piles, but also gives the required slope to the stack, which on level ground has to be secured by building up the foundations. A top dressing of cinders has been found satisfactory in some storage yards.

The following set of rules for piling lumber covers the more important points to be observed in the construction of foundations, shape of stack, arrangement of stickers, etc.:

RULES FOR PILING LUMBER.

1. FOUNDATIONS (ENDWISE OR SIDEWISE PILING).

(*a*) The foundations should be strong, solid and durable.

(*b*) The top of each foundation should be level, and from front to back the top surface of the parallel skids should be in alinement, so that the lumber will bear equally upon each one.

(*c*) The front foundation should be raised above the second, and the second above the third, to allow a slant in the stack of one inch to every foot.

(*d*) The foundations should be spaced not over four feet apart, except for heavy planks and timbers.

(*e*) The front foundation should be of sufficient height to provide space for free circulation of air under all parts.

2. LUMBER (ENDWISE PILING).

(*a*) Skids, preferably 2 in. by 4 in., should be laid on top of the foundations.

(*b*) Boards of equal length should be piled together.

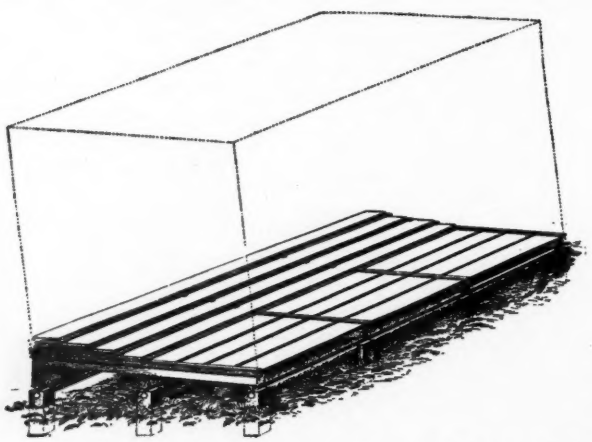
(*c*) The ends of the boards should rest upon the front and rear skids.

(*d*) A space of approximately ¾ inch should be left between boards in the same layer.

(*e*) Lumber piled in the open should have the front ends of boards in each layer slightly protruding beyond the end of the layer beneath, to give a forward pitch to the stack.

3. LUMBER (SIDEWISE PILING).

(*a*) Skids, preferably 4 in. by 6 in., should be placed across the foundations at about 4-ft. intervals. The number of skids depends upon the thickness of the lumber.



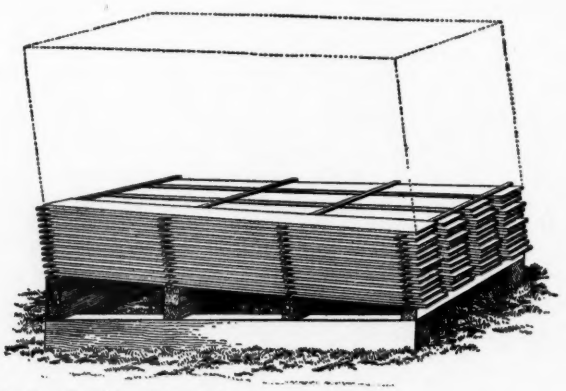


Fig. 1 and Fig. 2. Two Methods of Piling Lumber

(*b*) Boards of equal length should be piled together.

(*c*) The boards should be placed on the skids, with about ¾ in. between boards in the same layer.

(*d*) Lumber piled in the open should have the front board in each layer project slightly beyond the board in the layer beneath, to provide a forward pitch to the stack.

4. STICKERS (ENDWISE OR SIDEWISE PILING).

(*a*) Stickers should be of uniform thickness, preferably ⅞ in. for 1-in. lumber and 1½ in. for 2-in. lumber. Their length should be a few inches in excess of the width of the pile.

(*b*) Stickers should be placed upon the layer of boards immediately over the skids and kept in alinement parallel to the front of the piles.

(*c*) The front and rear stickers should be flush with, or protrude beyond, the ends of the boards.

5. ROOF PROTECTION (ENDWISE OR SIDEWISE PILING).

Cover boards, as a roof protection, should be laid on the top of the pile, extending a few inches beyond the front and rear ends of the stack.

6. SPACING STACKS (ENDWISE OR SIDEWISE PILING).

Space between the piles should not be less than 2 ft.; 4 or 5 ft. is preferred if yardage conditions permit.

7. DIMENSIONS OF STACK (ENDWISE OR SIDEWISE PILING).

The customary width of stacks is from 8 to 16 ft. The height is governed by the size and character of the lumber and by the methods of moving it.

8. TREATED ENDS (ENDWISE OR SIDEWISE PILING).

The ends of lumber 2½ in. thick or over, unless of the lower grades, should receive a brush treatment of paint or some liquid filler.

FILLING TRESTLES ON THE SOUTHERN PACIFIC

Methods Followed in Excavating and Handling the Material, A Summary of the Unit Costs.

BY W. E. BURNS,
Assistant Engineer, Southern Pacific, Keene, Calif.

WHEN THE SOUTHERN PACIFIC was first constructed through the mountains of southern Oregon, it was more economical to build trestles than to construct heavy cuts and fills, so for many years this company maintained some high trestles through this region. However, as the years passed, and the development of Oregon led to greatly increased traffic and a proportionate increase in wheel loads, the cost of maintaining these high trestles was great. Then, too, as Oregon is heavily wooded, there is an ever present danger of forest fires, so that watchmen had to be employed throughout the summer.

These high maintenance charges soon caused the company to establish a definite policy of replacing all of these trestles gradually with some permanent type of construction. For the last 12 years when any of these trestles have come up for renewal, they have been replaced with a fill or a viaduct, the choice depending on the amount of waterway required. Any canyon whose waters could be carried through a 24-ft. arch was filled.

This program has resulted in the complete elimination of high trestles on the main line of the Southern Pacific in Oregon. During 1917 this company filled a large trestle in northern California, so that there now remains only one large trestle in the 600 miles of the main line between Sacramento and Portland.

Some time ago, in the carrying out of this program, the trestles in what is known as the Wolf Creek loop came up for renewal. This section of track contained three long, high trestles, all within a space of half a mile, including in all 1,000 ft. of trestle averaging 70 ft. high. The grade was 2.2 per cent, with a maximum curvature of 10 deg. As the water could be disposed of through arches it was decided to fill these trestles.

Before work was begun, a very careful and thorough investigation was made of possible line changes, and estimates were made of the relative cost of the different layouts. The cost of different borrow pits was also tabulated, and it was decided that the best results could be obtained by securing the filling material near the trestles, although this necessitated handling a vast amount of rock. The reason for this decision was that the work must be done at the very height of the summer traffic, making the long haul of work cars impracticable. It was decided that the best results could be obtained by cutting the borrow into three separate pits. By doing this and by taking advantage of a new alignment, one high trestle was entirely eliminated; one could be partly filled from the old structure, and the third, which was 70 ft. high and 450 ft. long, could be filled on the old center line.

The ground under this trestle was filled with springs, so before work was started each spring was located and the water piped to the concrete arch or to a point outside the slope line of the embankment. These pipes were of concrete and were placed from two to three feet in the ground and back-filled with small stone and gravel so as to give good drainage from the spring, even in case the future fill should crush the pipe.

The waterways were concrete arches, built by the bridge and building forces. These arches should have been completed before the work of filling started, but as no money was available until the beginning of the fiscal year, the work was carried on at the same time as the filling, which could not be delayed longer on account of the very short, dry season. For this reason the work could not be handled as economically as it might have been.

The work was handled under the direction of F. M. Siefer, division engineer, with the writer an assistant engineer, having direct supervision and reporting to the roadmaster responsible for that portion of the track. This gave the job sufficient supervision and at the same time permitted the roadmaster to spend his entire time on other matters. It has been proven by the Portland division that attempts at economy in matters of supervision are expensive and that an engineer in actual charge of such work is not an expense but a direct saving in many ways.

The plant consisted of a 95-ton Bucyrus shovel with a 5 cu. yd. clipper and ten K. & J. 20-yd. automatic air-dump cars handled by a consolidation engine. The drilling was done by a Burley drill operated by steam, furnished from a donkey engine on skids instead of air. This engine was moved by its own power and kept close to the drills. The churn drills used for drilling the top completed the outfit.

The force consisted of a steam shovel crew with 6 pit men, a carpenter gang of 10 men, a combination track and drilling gang, and 2 crews on the Burley drill, as it was operated day and night. There was in addition a work train crew of 6 men. From the first the work was handicapped by the fact that it was done on the only line between Portland and San Francisco during a summer when an unusually heavy passenger traffic was being handled, which made it necessary that this line be kept open for traffic continuously.

As stated before, this fact governed the choice of the borrow pit and the final location was made because of its proximity to the work, but it contained about 60 per cent porphyry with soft shale and clay. The porphyry was broken by small quartz seams, which caused a great deal of trouble in drilling and shooting the bottom.

The shooting could not be done in the usual manner, as the main line was very close to the borrow and so situated that there was very little room for breaking down the bank. Experience soon showed that the best method of procedure was to shoot the bank in short sections of 60 ft., the bottom being drilled by the Burley and the top by the churn drills. The holes were about 20 ft. apart, so that three top and three bottom holes could be shot with the battery. This broke the rock fairly well except when quartz seams were encountered, which generally left large boulders. These often interfered with the operation of the shovel and caused delays, as the shovel could not handle its full capacity on account of waiting while these boulders were broken. A careful record of the time lost on this account was kept and was found to be 7 per cent of the time that the shovel was operated.

The material had to be hauled only a short distance to the fill, but considerable time was lost each day owing

to the heavy traffic. A careful account was kept of this lost time and a record showing the total time lost per day as well as the average is given below.

Many difficulties were encountered, the chief of which were landslides which buried the shovel. The nature of the bank was such that these slides came unexpectedly, giving no opportunity to clear the shovel. The filling was completed just as the rainy season set in. At the last minute it was decided not to pull the trestle stringers, as had been the original intention, but to allow them to remain through the winter and remove them the following spring. A heavy snow, followed by a warm rain, came, and when the fill settled it was necessary to retain both a bridge and a small track gang to keep up the track and fill. During later rains the water followed along the stringers and caused a small slide on one of the fills. It was then necessary to pull the stringers during the rainy season and at a greatly increased cost.

From the time that the shovel arrived at the work until it was dismantled and shipped away was 110 working days. The shovel did not work Sundays, as that day was used to catch up loose ends and make repairs to equipment.

The average output per day was 1,250 cu. yd. During the 1,100 hours the shovel might have operated 380 hours were lost as follows:

Repairs to shovel	40 hrs.
Moving shovel	51 hrs.
Setting up and take down	30 hrs.
Taking water and oil	8 hrs.
Slides	41 hrs.
Drilling and shooting	77 hrs.
Meeting trains	107 hrs.
Spurring out	16 hrs.
Repairs to cars	2 hrs.
Track	8 hrs.

The cost of the work was as follows:

	Per cu. yd.
Engineering and superintendent	$0.0042
Temporary track	0.0108
Watching trestle at night	0.0028
Temporary trestle for filling	0.0054
Aprons for filling	0.0133
Lining trestle during fill	0.0082
Grading	0.1295
Drilling and shooting	0.0232
Car rental	0.0104
Work train	0.0550
Pulling stringers	0.0058
Track gang after fill completed	0.0232
Carpenter	0.0112
Total cost per yard	$0.3030

The Value of the Personal Incentive

BY DIVISION ENGINEER.

THAT THE RAILROADS of the country recently faced the problem of getting an adequate supply of maintenance labor and with the equally or more important problem of keeping it, is a question which has passed the point of discussion and looms up as one of the most absorbing factors of maintenance work to-day. The *Railway Maintenance Engineer* has published some excellent discussions of the methods of hiring, feeding and housing maintenance labor in previous issues, and has left but little to be said on these subjects. However, the method of employment is the beginning of the working conditions; it should be fair, truthful and free of exploitation. We cannot expect to find only experienced trackmen coming to the roads for work; in fact, a very large percentage of the men that can be had are strangers to maintenance work. The present method of training is not greatly at fault, as to-day the foreman is glad enough to get a man who is willing to work and is sufficiently patient with him to teach him.

One of the great handicaps in the past was the rate of pay. Generally the pay of track laborers was somewhat below that of labor in adjacent industries, and as a result the standard of the track laborer was reduced considerably. Of course a marked change in wage relationships has taken place in the last year, but it must be remembered that the men now of the forces are largely those who were attracted and hired under the low rates formerly prevailing; in other words, inferior workmen.

In numerous places the living conditions of track laborers are being improved. It is safe to say these conditions will have to be brought to a reasonable standard everywhere in order to hold the present force and to attract others. On sections at outlying points particularly some attention must be paid to the housing of laborers' families. The bunk house for a gang of single men no longer proves adequate and the necessity for taking care of laborers' families is becoming apparent where these men are desired for permanent employees.

"Seasonal" track work imposes a hardship upon directors of maintenance labor. The short working season and the need for the men to find work of some other nature during the winter are conditions which contribute greatly to a floating and capricious character of labor in the summer, or northern working season. True, some roads by reason of their geographical location and limits, can do no other way than work when the weather or season permits; others covering greater latitude, can so manage their work as to make their heavier demands for labor north in summer and south in winter, and make the work much more nearly permanent, and with considerable improvement in the personnel of the gangs. To propose such a movement for section forces too closely approaches the Utopian (so far as the laborer might be concerned) for further consideration.

The manner of making the heaviest labor demands in all parts of the country in the same season frequently results in the northern portion of a railroad bidding against a southern section of it for labor, and occasionally "invading" the southern section's labor field. Because of the northern lines' ability to pay a higher wage owing to his shorter season and the necessity for intensive track work during the season, the labor condition in the south is rendered more unsatisfactory, and the individual made more dissatisfied with his pay and his work than before. Track labor, particularly in extra gangs in northern territory, is undoubtedly affected by the seasonal feature, and in many instances the men start out with the idea of getting all they can for the least effort, feeling that the opportunity each year is short lived, and that time flies.

Another feature capable of improvement is the means of rewarding special effort. Uniform rates of pay for all men in a gang allow no leeway, and there is little opportunity for advancing the best workmen. The beginner and the "old head," the man tugging on the traces and the one who just "gets by," the jackmen in the surfacing gang and the ordinary laborer in it, all draw the

same wage, though the intelligence and will with which they go at their work are in considerable contrast.

Promotion to foremen should come from the ranks of the men employed, preferably through the apprentice foremen grade, if any hope of advancement is to be extended. Without it can we expect anything but drones?

Failure to recognize the fact that track work well done is skilled labor, and the fact that the track laborer is, in many instances, considered the lowest grade workman on the railroads, is not conducive to recruiting a self-respecting and snappy class of labor. An efficient track laborer is not made in a day and some credit should be accorded him for his successful effort to become one. Does the fact that track work is placed under the category of "common labor" affect the class of entrants to its ranks? Here is a good gage—where do you find the sons of the track foremen? Not in the ranks of maintenance employees. If they enter railway service they go into some other work. That some future should be held out as possible to a young man starting track work cannot be denied if fellows who can be developed and promoted are to be expected.

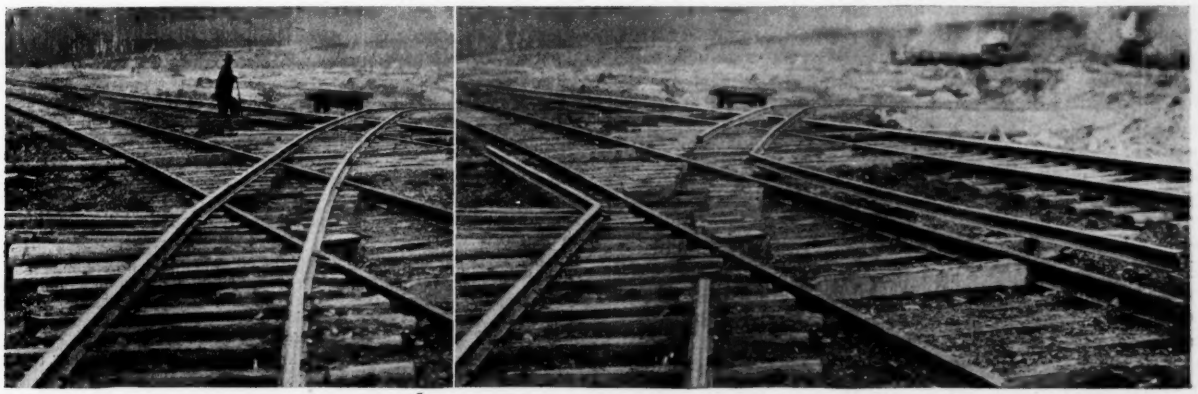
The laborer should be able to look forward to the possibility of holding the foreman's job. The foremen ought to be able to feel that the supervisors and roadmasters will be picked from men of their class. Without some hope of this kind, what kind of candidates can be expected? Secretary Daniels of the Navy found it expedient to tell the young men of the country that there was a road to a commission through the ranks of the navy and the marine corps; he didn't say it was easy, but it was possible. Of course, every track laborer cannot be expected to be a potential foreman nor every foreman a future roadmaster, but the way should be there.

A Makeshift Railroad Crossing

THE PASSAGE of construction trains across operated tracks in the course of construction or maintenance operations is a source of concern and trouble alike to the officers responsible for train operation and those concerned with the movement of material trains using the construction tracks. Because of this underpasses or overcrossings are commonly resorted to wherever the physical conditions will permit, but such is not always the case and as special crossing construction for such temporary use is out of the question the layout of tracks for handling material is seriously hampered by an inability to secure a satisfactory crossing at grade.

This difficulty was overcome recently in hauling the filling for the approach to a bridge on the Chicago & Eastern Illinois near Findlay, Ill., where 350,000 cu. yd. of material was handled in 12-car trains of 4-cu. yd. Western dump cars on a 3-ft. gage track. The material was taken from borrow pits on the east side of the track at each end of the bridge and the situation was such that the filling was first placed for the northbound or east track, which was placed in operation as soon as the embankment was of a sufficient width. Subsequently a gauntlet was installed on the east side of the embankment to afford a minimum of interruption to the operation of the double track line. In consequence of this the widening of the embankment for the second track necessitated the placing of the construction track on the shoulder of the embankment to the west of the operated gauntlet tracks, thereby necessitating a crossing of both main tracks beyond the end of the embankment in order to reach the borrow pit.

The manner in which this crossing was accomplished without cutting the main tracks is shown in the accompanying photographs, where the rails of the construction track are seen to pass over those of the main line tracks with provision for swinging the obstructing rails of the construction track out of the way when necessary to allow the regular trains to pass. The bases of the construction track rails are on a level with the tops of the main track rails, ties and blocks being placed between and outside the main line rails for this purpose. The joints in the construction track rails were so placed that a single rail length spans both the rails of each main track with adequate space outside each rail for clearance. These rails are not bolted or spiked to the supporting blocks, but are held in place by simple tie bars engaging their bases and by the joint fastenings at each end. At the end of the rail serving as a pivot the joint connection consists of a hinge, formed by forging eyes on the ends of fish plates which are bolted to the webs of the adjoining rails. The other ends of these rails are held by splice bars with slotted holes which permit the sliding back of the splice bars to clear the rail when necessary to swing it out of the way.



The Crossing, Closed and Open

Whenever the rails are to be swung clear, the spikes

which hold the tie rods in place are pulled and the splice bars on the swinging end of the rails are slipped back. The rails are then slid toward the track center far enough to free the tie rods, after which they are swung out across the main track rails into a position outside of and parallel to them, as shown in one of the pictures. These photographs also show the skid block between the rails of the main track shod with a piece of bar steel to facilitate the sliding of the rails. These skids are kept greased and one man has no difficulty in moving the rails alone.

The regular trains were operated through this section on a slow order and enginemen had orders not to proceed by these temporary crossings until given a hand signal by the crossing tender; however, the traffic was not delayed in any way on this account owing to the fact that the track could be cleared in a very short time. For instance, in one case observed, the crossing tender cleared one main track in 58 sec. The filling work was done by the Roberts Construction Company, Chicago, under the direction of R. J. Gjerde, superintendent.

DIFFICULTIES OF RAILROAD CONSTRUCTION IN ALASKA

SOME IDEA of the difficulties imposed on the forces of the Alaskan Engineering Commission in the construction and operation of the Government Railway in Alaska is to be obtained from the report of William Gerig, engineer in charge of construction work on the Anchorage division of this road, covering conditions experienced during the last year or more. Ice on the track interfered with train movements during the week of December 7. Warm weather, accompanied by rain, early in that week caused a flow of water over the flats between Mile 57 and Mile 68, and then a sudden change to cold weather left about an inch of ice on the rails. Trains could not run until the ice had been picked away by hand, as no machinery was available to remove it. Traffic was not resumed until Sunday night, December 8.

The glaciered route between Mile 57 and Mile 68 is low and flat. In the opinion of government railroad officers, the most feasible method of preventing ice blockades is to raise the tracks four or five feet.

The winter of 1917-1918 was the coldest and longest experienced since the beginning of work on that part of the Alaskan line. It set in during the latter part of October, 1917, and continued until late in May, 1918. Considerable snow fell in the Turnagain Arm district, causing many snow slides on the south end of the district. This created such a dangerous situation that it was necessary to suspend all grading during the month of March. It was not until the last week in April that the danger was past and that the men returned to work.

Thawing weather late in April caused mud slides and soft tracks. Track forces were increased for maintenance work, but as the ground was still frozen, permanent repairs could not be made. During May the ground had thawed sufficiently in the Turnagain Arm and Matanuska districts so that forces were increased and permanent repairs to track were made. When the weather did moderate the temperature rose rapidly, causing floods in the Matanuska and other rivers. As these glacial streams change their channels rapidly during floods, it became necessary to do an excessive amount of riprapping.

From Houston northward in the Talkeetna district, the roads were practically impassable during the month of May on account of the depth of snow during the earlier part of the month and subsequently on account of heavy rains and thaw, which made them very muddy. Throughout nearly the entire month the Susitna river was frozen over and ice did not commence breaking up until May 26.

There was a big flood in the Knik river, extending over a period of three weeks, which required constant patrolling by a large force in order to prevent damage to railroad bed and bridges. Little damage was done outside of the loss of some 8,000 ties, which had been stored on ground supposed to be above high water. During July and August, there was little rain and consequently many forest fires occurred. One very destructive fire at Mile 83 destroyed a construction camp and supplies valued at about $40,000, but fortunately no lives were lost. In September at highest tide, a wind storm damaged the roadbed between Mile 83 and Mile 88.

AMERICAN RAILWAY ENGINEERING ASSOCIATION COMMITTEE ASSIGNMENTS

THE WORK ASSIGNED to the 22 regular and 2 special committees of the American Railway Engineering Association for the coming year has recently been announced in a bulletin issued by the secretary containing the names of the committee members and a complete outline of the work of each committee. The same information is contained in circular S-II-1, issued by the American Railroad Association, Section 2, Engineering. A large part of the work assigned to the committees is held over from previous years and is more or less familiar to those who follow the work of these committees, while the new subjects assigned to the committees for investigation during the present year are given below:

Ballast—Report on the use of reinforced concrete slabs or other devices to assist the ballast in distributing the load on soft roadbed.

Rail—Present revised specifications for steel rails. Present sections for rails heavier than 120 lb. per yd. Report on "Frictionless" rail. Report on the effect of usage on the physical properties of rail steel.

Track—Investigate and report upon the design and use of the "clamp" type of frog.

Buildings—Review recommendation as to applicability of the high platform.

Masonry—Investigate the distribution of loads through ballast and embankment as affecting the design of masonry structures. Report on methods of conveying and depositing concrete.

Signals and Interlocking—Investigate and report on the effect of the use of ties treated with any solution which affects the length of track sections.

Water Service—Report on the design of impounding reservoirs and conditions under which they are economical. Submit definitions applicable to water service. Report upon plans and specifications for typical water station layouts, collaborating with the Committee on Yards and Terminals and Committee on Economics of Railway Operation.

Yards and Terminals—Report on unit operation of railroad terminals in large cities, revising the catechism as a statement of principles for inclusion in the Manual.

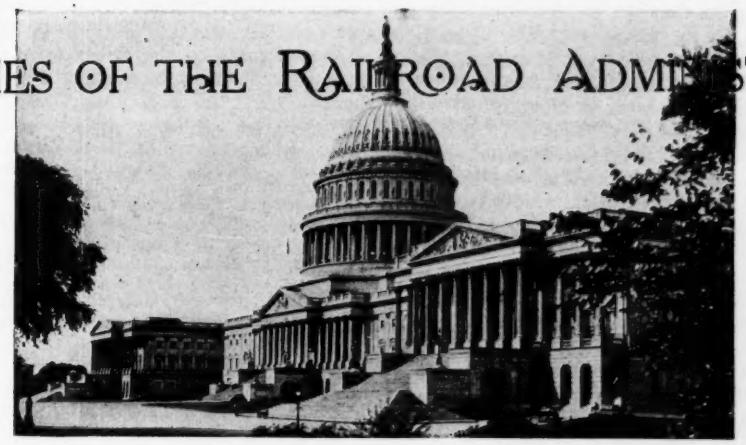
Wood Preservation—Report on the availability and use of sodium fluoride as a preservative for cross ties. Report on creosote treatment to be used in the protection of piles and timbers in teredo-infested water, specifying the amount of creosote to be used. Report on the comparative value of grades 1, 2 and 3 creosote oil and creosote coal tar solutions as preservative agencies.

Electricity—Continue collecting statistical data relative to clearances of third rail and overhead working conductors and submit revised tables as the next annual meeting. Co-operate with the Bureau of Standards in the preparation of the proposed National Electrical Safety Code and other safety codes of similar character. Submit specifications for insulated wire and cables.

Economics of Railway Labor—Study and report upon methods for training and educating engineering and maintenance department employees.

ACTIVITIES OF THE RAILROAD ADMINISTRATION

Maintenance Budgets Now Being Prepared. Price Plan Fails



Tie Situation Showing Marked Improvement Since Armistice

Washington, D. C.

FIGURES ON WHICH the 1919 budgets of maintenance of way and structures expenditures are to be based are now being compiled by the railroads under federal control and are to be submitted to Washington by May 1. These are to be based on instructions issued by C. A. Morse, assistant director of the Division of Operation, some time ago, which are being somewhat modified in order to reduce the amount of clerical labor required in complying with them, under which the amount of upkeep this year is to be measured by the amount necessary to make the average for 1918 and 1919 equal to the upkeep during the test period, after equating for the increases in labor and material costs. Therefore the maintenance work is not, in general, being delayed until the budgets are approved because the general standard to be reached is known. Information received here is that maintenance work is now being actively prosecuted, but the compilation of the figures showing the comparison for last year with the test period will afford a more accurate guide for pushing or curtailing the work for the balance of the year.

Circular No. 28, issued by the Division of Operation under date of March 1, calling for a mass of detailed information for the purpose of affording a comparison of the expenditures for maintenance of way and structures in 1918 and in the three years ending June 30, 1917, which is necessary to comply with the contracts between the government and the railroads so that each property may be returned in substantially as good condition as when taken over, is to be cancelled because it has been found that it would require a laborious and expensive duplication of the work which will be necessary to furnish similar information under circulars to be issued by the Division of of Accounting. It has been decided that the information required by the maintenance department can probably be secured in sufficient detail from the returns from the accounting circular which it is planned to have in by about July 1.

The Rail and Tie Situation

Statistics being received by the maintenance department of the Railroad Administration show that the tie situation has been improving rapidly since the signing of the armistice, which has alleviated the labor shortage, and, particularly since the organization which was being built up last year, has had an opportunity to develop and ascertain the results of its work. Tie production during the month of February showed a marked increase, amounting to approximately 7,994,000 ties, and more in March as compared with a total production during the six months from August to January, inclusive, of less than 30,000,000. Since October the monthly production for the country has nearly doubled, and in some regions it has more than doubled. The present outlook is that there will be enough ties produced this year not only to meet the current requirements, but to provide for the usual carry-over into next year. Arrangements have been made for treating a larger number of ties made from the inferior grades of wood than before, and also for the transportation of 5,000,000 Oregon fir ties from the Pacific Coast to the Eastern region. The reports which have been received since the close of the year show that the tie situation last year, particularly after the improvement during the months of October, November and December had had its effect, was far better than would be indicated by the general impression created by the complaints from districts where there was a shortage without making allowance for those districts where there was a surplus. A total of 79,000,000 ties were inserted in 1918 for renewals alone, as compared with 81,000,000 in 1917 and 90,000,000 in 1916, while the latter figure represents the approximate average for five years.

Rail renewals last year also compared less unfavorably with previous years than preliminary estimates indicated. For the calendar year they amounted to 1,097,000 tons, as compared with 1,233,000 tons in 1917, 1,450,000 in 1916, and an average of about 1,600,000 for ten years. These figures are less than the total used on rails on steam railroads because they take into account renewals only, and not those used for construction, which until recent years accounted for a large percentage of the rail production. In 1918 there were about 460,000 tons of rail carried over from the previous year, while about 369,000 tons were carried over from 1918 into 1919.

Steel Price Controversy

One of the most important of the recent developments at Washington has been the controversy between the Railroad Administration and the Industrial Board of the Department of Comerce regarding the prices for rails and other steel and iron products, which has resulted in an announcement by Director-General Hines that he cannot agree to accept the prices fixed as being sufficiently attractive to induce him to enter the market or even as being reasonable. While his statement did not amount to an assertion that he would not buy, it has been made clear that he does not consider it necessary to do so in the near future, and that he hopes, before the deliveries on old orders are completed, to be able to place orders at a price lower than that now offered. Meanwhile the entire controversy involving the policy of the Industrial Board and the question as to whether

it is authorized to fix prices that shall be binding on anyone, has been referred to the President, who approved the general plan of price stabilization in the first place and provided the board with funds from his own contingent fund, but who has not been in close touch with the working out of the plan. The President's instructions, cabled on April 18, that the price negotiations be reopened calls for a reorganization of the board, which had practically suspended its activities, as the position taken by Mr. Hines that the board's entire function was that of a mediator seems to be supported by most of the cabinet officers except Secretary Redfield of the Department of Commerce. While Mr. Hines' refusal to accept the prices fixed applies to the entire steel list, and the board was so informed before the list was published, the controversy has centered mainly around the rail prices, and especially the figure of $47 a ton for open hearth rail. While the board reached an agreement with the steel interests on a figure that would protect the companies whose production costs are higher than those of the U. S. Steel Corporation, the Railroad Administration has based its arguments on the costs of the larger company, which it believes would be making too large a profit at the fixed price. Chairman Peek, of the Industrial Board, has stated that the increased wage cost of the steel company, added to the $30 pre-war price, would make a total of over $48 a ton, while the Railroad Administration's purchasing advisers have regarded the former price as including a large profit and have referred to the Federal Trade Commission figures showing a cost of $40 a ton, including $4 of inter-company profits. Moreover, Mr. Hines says that progress toward a restoration of normal conditions would be seriously retarded by the approval of a government purchasing agency of prices which it deems excessive.

Railroad Administration officers believe that while it might be desirable to place rail orders now, a sufficient amount to meet the immediate requirements can be obtained from the old orders, on which approximately 1,100,000 tons were undelivered on January 1 and which are now being delivered at the rate of 35,000 to 40,000 tons a week. About half of the amount has now been received, and the balance will be coming in until perhaps the end of August, depending on how soon orders of individual mills are completed.

The Division of Operation has issued Circular No. 19A, setting forth revised rules for the issuance of annual and trip passes, which supersedes Circular No. 19, dated September 1, 1918. These regulations prescribe in detail the manner in which these passes shall be issued and enumerate those officers authorized to issue them.

In Circular 199, dated April 8, the director of the Southwestern region states that in view of the recent reduction in the price of new rail that it will be satisfactory, effective on that date, for relay rail to be sold for the construction and repair of industry tracks at a price of $40 per gross ton. Surplus relay rail weighing 60 lb. per yd. or less which may be available for sale or lease on individual railroads can be so disposed of by the Federal Manager, using $40 per gross ton as the value to be set on such rail leased. In the case of a proposed sale for any purpose other than the construction or repair of industry tracks the matter should be referred by the purchasing agent on the road to the regional purchasing committee for approval.

CROSS TIE PROBLEMS

The regional purchasing committee in the Northwestern region has issued Supplement No. 17 to R. P. C. Circular No. 19 relative to the application of the standard Administration specifications for cross ties, which contains diagrams showing the dimensions of the various grades of ties acceptable or to be rejected.

The director of the Division of Purchases at Washington has written the regional directors relative to payment of cross ties as follows:

"Reports are coming to us, from time to time, that the railroads are not paying the tie producers promptly for ties that have been taken up, and that this failure to pay promptly is affecting the production. I shall be glad if you will investigate the situation on the various railroads in your respective regions, and, if the bills are not being paid promptly, arrange to expedite payments as much as possible, so as to encourage the maximum production. If any of the railroads have not sufficient funds with which to take up ties promptly, I will be glad if you will communicate with me by wire and advise me the amount necessary, so that I can arrange to have necessary funds provided through the Division of Finance at Washington."

In Supplement No. 16 to Circular R. P. C. No. 19, dated March 28, the Purchasing committee of the Northwestern region states that the director of the Division of Purchases has issued the following ruling under date of March 20, relative to the responsibility of the exporting railroad for the proper inspection of ties shipped by it to the importing railroads:

1. On all shipments made during 1918 no bills either for rejects or for differences in classification should be made.
2. On shipments made between January 1 and March 31, 1919, inclusive, the importing railroad will charge the exporting railroad for any loss resulting from the shipment of rejects, as determined by the Forest Products Section of this Division.
3. On and after April 1, 1919, the Forest Products Section will include in its reports of reinspection any acceptances by the exporting railroad of grades 2, 3, 4 and 5, which are in error more than 10 per cent, in addition to its decision as to absolute and usable rejects, and the difference in value indicated by such reinspection will be charged against the exporting railroad.
4. No charge shall be made for reinspection or rehandling by either railroad.
5. Freight charges on rejected ties shall be paid by the importing railroad.

WAGE HEARINGS

Representatives of Engineering Council (an organization of the national societies of civil, mechanical, electrical and mining engineers and the American Society for Testing Materials) and of the American Association of Engineers appeared before the Board of Railway Wages and Working Conditions at Washington on March 31 and April 1 and 2 to present the cause of the engineers in railway service in the matter of wages. Arguments and data were presented to show that the wages of the employees of the engineering departments have not been advanced in accordance to those in other departments.

Committees representing the United Brotherhood of Maintenance of Way Employees and Shopmen have been in conference during the last month with committees of representatives of the regional directors regarding uniform arrangements as to rules and working conditions to be applied on all railroads under federal control. The committees consist of fourteen representatives of the employees and two representatives of each of the seven regional directors. They are expected to submit recommendations to the Board of Wages and Working Conditions, which in turn will make recommendations to the Director-General. The meetings are confidential until the decision of the Director-General is announced. In addition to the proposed set of rules and working conditions the maintenance of way employees have also submitted a request for a further increase in wages, but this request was declined by the Director-General and has since been withdrawn by the organization.

WAGE INTERPRETATIONS

The agreement with the section foremen and section laborers on a certain railroad provides that 10 hours'

work shall constitute a regular day's work on Monday to Friday inclusive and that 8 hours shall constitute the regular day's work on Saturday. The agreement also provides that time and one-half will be paid for time worked after the regular day's work. Employees received 10 hours' pay for Saturday and contend that inasmuch as they were receiving 2 hours' bonus time for Saturday under the agreement, they should continue to receive this bonus after the establishment of the basic 8-hour day. The question was raised whether it was the intention of Supplement No. 8 to General Order No. 27 to reduce the hours from 8 to 6 for a day's work on Saturday and to allow 8 hours' pay therefor. In interpretation No. 3 to this supplement the decision was no. The question was further raised whether it was the intention of Supplement No. 8 to preserve 10 hours' pay for 8 hours' work, to which the answer was yes.

Interpretation No. 4 to Supplement No. 8 to General Order No. 27 raises the question whether it is the intention that assistant track foremen who were paid on a daily, weekly or monthly basis prior to the application of General Order No. 27 should be placed on an hourly basis. The decision is that this should be done in accordance with Section D of Article 1 of Supplement No. 8, which states that rates of pay for all assistant track foremen will be five cents per hour in excess of the rates paid the laborers whom they supervise.

Another asks, if it is the intention to place assistant track foremen on the hourly basis, what method should be used in arriving at the new hourly rate. The decision is that the increase prescribed in Article 1 of Interpretation 1 to Supplement No. 8, observing the provisions of Section A, Article 4, of Supplement 8, provided that the hourly rates established shall not be less than 5 cents per hour in excess of the rates paid the laborers supervised. The increases prescribed in Article 1, Interpretation No. 1 to Supplement No. 8, referred to in the decision specify that eight consecutive hours exclusive of the meal period shall constitute a day's work and that the increases provided in Supplement No. 8 applicable to monthly, weekly and daily paid employees are based upon the recognized number of working days constituting a calendar year, including Sundays and holidays, where they have been considered a part of the employees' assignment. Section A of Article No. 4, Supplement No. 8, provides that uniform rates and all rates in excess thereof established in this supplement and higher rates which have been authorized since January 1, 1918, except by General Order No. 27, shall be preserved.

GASOLINE STORAGE

Circular No. 198, issued by the director of the Southwestern region, calls attention to the dangers of open storage of gasoline. It approves the practice of burying gasoline storage tanks outside the tool houses or other structures and suggests its adoption. The use by employees of open lights where gasoline is stored should be strictly prohibited.

Overcoming Neglected Maintenance in a Terminal

BY W. F. RENCH

ON NOVEMBER 1 of last year it became imperative that extensive renewals should be made in a terminal yard serving three important divisions of a railroad in the eastern territory. At that date the tie renewals for the year had not been started and surfacing and rail replacement had been practically suspended for a period of two years. It was appreciated that the open season might end suddenly and that a program of quick repair was therefore in order.

Labor was scarce and such as could be had was both inefficient and independent. It was only after the signing of the armistice that men became obtainable in numbers, and it was several weeks more before the labor became subject to strict discipline. A force of 94 men was organized into six separate gangs, and among these there were interspersed about 25 laborers who had shown some ability in track work. A work train was put on whose sole function was to maintain the flow of material and perform the necessary policing. Besides the work train force of 18 men, there was a switch gang of 20 men, 2 tie gangs of 18 men each, a surfacing gang of 12 men and a picked gang of 8 men, mainly for resetting guard rails.

Because of the lateness of the season it was felt that the tie renewals should be given first consideration. The transportation department appreciated the need of cooperation and gave the use of tracks as required. The yard has two main tracks through the center for northward and southward movement, and 11 receiving tracks for traffic in each direction; these converge over humps and lead into classification yards of 22 tracks. Further drilling is done at each end of the classification systems for assembling into trains the several units of classification. Advance tracks in each direction relieve the yard of trains as fast as made up. Through each of the two receiving yards a track is kept open for the return of hump engines and for other uses. While renewals were in progress in these yards the track being renewed was made the thoroughfare track temporarily and the regular track was used for receiving, as the classifications in both yards just equaled the number of the tracks. The surrender of even one track entailed some inconvenience in operation, and it was the rule to employ both tie gangs simultaneously on such tracks. When renewals were going on in the receiving yard one of the tie gangs was engaged in renewing switch ties.

The ties for the renewals were stored at the humps and at the four points at the north and south ends of the yard proper. The required number of ties was taken on to the selected track upon hand trucks and, in the case of the classification tracks, the switches at each end of the track were then spiked. This was necessary to prevent injury to the men from cars being run onto the track by error, and to assure that departure from the track with the old ties would not be obstructed. For the safety of yard employees the duty of removing the old material was performed before closing the day's work, regardless of circumstances. Care was likewise taken to collect and bring out scrap or any other rough material that might be found. The old ties were piled at the humps and in due course were loaded up and taken away by the work train. Frequently in the classification yards, and to a less extent in the receiving yards, joints were found pulled apart, and it was necessary to butt the rails back to close the joints. Any bad surface was corrected by the surfacing gang, but a general surfacing of the yard was not undertaken along with the tie renewals. The ties were marked after careful testing with a pick and none was removed that would last six months. By this plan it was possible to renew the entire 66 tracks before the close of the year and put the other physical features in fit condition for safe operation through the winter. As

the men assigned to tie renewal were inexpert it was found preferable to apply the ties by digging them in rather than by raising the track with the jack, for, with such labor, the latter method is sure to result in high spots being introduced, and the surface was already deficient almost to the limit of safety. To avoid the likelihood of broken rails insistence was had that the ties should be tamped thoroughly.

When the tie program was well in hand the surfacing gang entered upon a more general plan of surfacing and special attention was then given to retamping the ties recently put in. It happened that a falling off in the movement, which had been unusually heavy, occurred just before the holidays and permitted surfacing without the need of tracks being given up. The surfacing gang was given notice when it was necessary to occupy a track and moved to another place. An important part of the work of this gang was to drive down raised spikes as the ties were tamped up to the rail. Time was not available for a regaging, but a close watch was kept for bad gage, either close or wide, and such conditions corrected. Incidentally, the ties applied were mainly treated, although a number of chestnut ties were used. These two kinds have demonstrated their usefulness in yard repair by reason of their increased life.

The gang assigned to guard rail adjustment found conditions requiring urgent attention. This was particularly true on the approach side of the humps. The shoving necessarily causes creeping of the rails, and this is, of course, greater along the line of rail ending at the switch point, because it is free to advance unless held by rail anchors. This results in a tightening of the gage of the track and a loose condition of the guard rail gage. In some cases this had advanced to the point where the wheels could mount the point of the frog. The gang also found points where the turnout rails had pushed out, causing not only wide gage, but defective line; many of the switch points were well worn because of a scarcity of material for renewal while war demands existed, but the shortage was relieved about this time through the operations of a newly-established reclaiming plant at the location of the yard. By means of the oxy-weld process worn out switch points were filled out by the addition of metal and made entirely fit for yard use. Frogs also were similarly repaired and many cracked splices made serviceable. All cutting of rails at this plant is done with the oxy-acetylene torch. The guard rail gang made not only such replacements, but was available for broken rails and other emergencies where a larger gang was not required.

Although mention is last made of the operation of the switch gang its function was, in fact, the most vital. The engine yard at this point converges to a double track for inward and outward movement of the locomotives of the three divisions. The general line is on a 6-deg. curve, where a crossover and two other switches occur. These involved No. 8 frogs and with proper attention to line should not exceed 18-deg. curvature, although by reason of defective conditions the curvature at several places ran as high as 24 deg. There were 200 engine movements at this point daily, many of the locomotives being of the 2-10-2 type. Derailments in the past were frequent and the consequent delay in despatching trains was considerable.

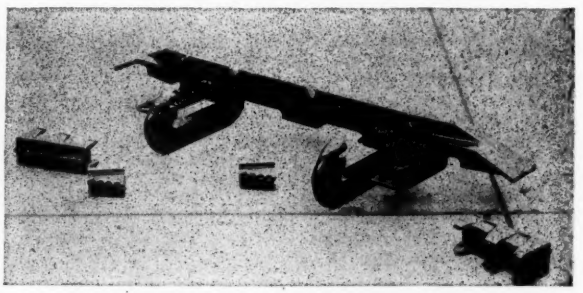
After a careful study it was determined that nothing would relieve the situation permanently except a general renewal of the layout, correcting irregularities of line and surface, but especially removing from the connections rail which had been kinked in various derailments. Upon the completion of the renewal of this layout accidents suddenly ceased.

A scarcely less troublesome condition occurred where a No. 8 crossover, also on a 6-deg. curve which connected two thoroughfare routes to the turntable, was closed to passage by the largest engines by reason of sharp curvature. The layout at this point was renewed with good quality 100-lb. rail and the turnouts relined, when operation was opened for all classes of engines. The ballast throughout the running tracks of the engine yard was worn out, and it was found that nothing would afford a substantial roadbed except to dig out the worthless cinders out of face and replace them with clean ash pan cinders. A light raise of the tracks was possible and this supplied a good bed and afforded drainage.

The total cost of this yard improvement for labor was $32,000, and in the light of subsequent experience it would seem that the expense was justified.

A NEW ADJUSTABLE GUARD RAIL

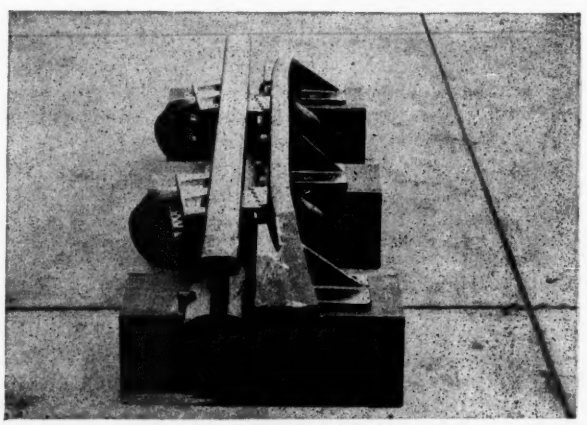
AN ADJUSTABLE guard rail of an entirely new type has been introduced recently by the Reading Specialties Company of Reading, Pa. It can be placed in position in a short space of time, its application being as easy as that of the ordinary guard rail since it can be



Parts of the Guard Rail

accomplished without pulling the spikes or otherwise disturbing the stock rail.

The photographs show the guard rail in place and detached. As may be seen in the illustrations it consists of the guard rail proper, the removable clamps, the adjustable fillers and the wedges. Its application is simple.



The Guard Rail Assembled

The guard rails themselves are first placed approximately in their final position and the clamps applied. The gage is adjusted by means of the wedge-shaped fillers, the faces of which are provided with interlocking teeth, after which the setting up wedges are driven tight. The

guard rail is then ready for spiking to the ties, the spike being driven in holes, provided for this purpose, in the braces.

The wedges are supplied with a flange, drilled for cotter pins to hold them in the proper position. The wedge feature of the fillers permits of adjustment for flangeway, wear, etc. The guard rails are manufactured in manganese, cast and open hearth steels.

How and by Whom Should Track Be Patrolled?

A SHORT TIME AGO we received a letter from a section foreman on a western road regarding the patrolling of track as follows:

I am employed as a section foreman on a large road in the middle west, the general manager of which has recently issued instructions that the section foremen must see both ends of their sections every day and that they personally must walk over their entire sections on Sundays. I have no doubt that the general manager had good reasons for issuing these instructions, but I think they are too rigid for times like these, when labor is so scarce. We have positive instructions not to do any work other than that necessary to the maintaining of safe and smooth riding track. We have to spend the larger part of the day getting to both ends of the section when we should be on the track and if the track gets a little rough we do not fail to hear from it.

When the question of patrolling of the track on Sundays was brought up, the manager decided that, as the foremen were paid for Sundays, they should be expected to walk the track. It seems to me that it is doing these men an injustice to expect them to walk from 12 to 18 miles on Sundays carrying heavy tools after having worked six days a week.

This brings up for consideration the entire question of track patrol and we publish below discussions of this problem, which is of special importance at the present time when tracks are weakened because of the deferred maintenance which exists:

THE TRACK WALKER AN EXCELLENT INVESTMENT

By F. J. MEYER

Roadmaster, New York, Ontario & Western, Walton, N. Y.

After several years of lean maintenance and at a time when every effort should be made to regain what has been lost, the matter of patrolling track has been brought forward in a manner which leads one to think that even at this late day there are railroad men unfamiliar with track patrolling.

There are three methods of track patrol and section inspection common to a number of roads. The first is where the foreman walks track himself. This is not a satisfactory arrangement, because, of necessity, the section gang is left alone a good share of the time and the track suffers accordingly. It also causes the foreman to walk track on Sundays and this is not consistent with a foreman's duties, while it lowers him in the estimation of his men. The second is where the foreman runs over his section daily with a hand car. This is costly and the inspection is not thorough. The foreman is also apt to acquire the unfortunate habit of traveling more than working. The third method used on many roads, and for many years found satisfactory, is to have a man assigned to trackwalking. To the uninitiated the daily walk of a trackwalker may seem unimportant or even unnecessary, but to the men familiar with a trackwalker's duties and responsibilities he is indispensable.

The trackwalker relieves the gang so it does not have to be taken from its regular work and the foreman can carry on a definite track program almost continuously. This in itself warrants the employment of a trackwalker, but there is another and far more important reason for the trackwalker, especially at this time when the track requires close watching. Covering a given territory daily the trackwalker is able to detect signs of failure before they actually occur. Take, for instance, the rail question. It is safe to say that the majority of rails give some outward sign before breaking and a man whose chief duty is to watch for such signs feels the responsibility, concentrates his mind on his work and takes great pride in detecting the blind defects. A foreman walking track with a gang working elsewhere cannot possibly give his best thought to track inspection when his heart is with his gang miles away.

Viewing the matter from a standpoint of dollars and cents only, trackwalkers are one of the biggest little investments a railroad can make. Aside from detecting the faults in the track and possibly avoiding accident, they keep the bolts tight, drive down spikes, make light fence repairs, open waterways, tamp a joint if need be and do many other things too numerous to mention.

ASSISTANT FOREMAN CAN PATROL TRACK

By ROADMASTER

To do away with or curtail the time-honored practice of daily track patrol would mean taking a long chance, particularly on heavy traffic lines, and under present conditions. The fact that tracks are more or less below par as to maintenance contributes to the necessity of rigid daily inspection. As a matter of protection to those directly in charge and held responsible for safety in operation, the knowledge that every part of their track is surveyed daily by a competent man is worth much. One would assume great responsibility to do away with this safeguard and have to answer for the accidents that might occur and which could possible have been avoided had the track been patroled. Rather than dispense with or curtail daily inspection I think the standards for its should be raised.

Where it is practical an assistant foreman should be made part of the organization for each section. His primary duty should be to cover the track daily, being held jointly responsible with the foreman for its safety. He should be examined on the book of rules and as well qualified as possible for the position. A man given the incentive of this promotion and the five cents an hour difference in pay over common labor which the new wage ruling provides for assistant foremen, would naturally give his work closer attention and get better results than the average trackwalker. In addition to inspecting track he could be given other assigned duties to perform. There are many one-man jobs on any section which can be performed single-handed at a great saving over having to stop to take care of them with the entire gang. By keeping up these loose ends, such as cleaning and oiling switches, tightening frog and switch bolts, replacing broken bolts, making light repairs to fences and cattle guards, keeping right of way gates closed, caring for road crossings, etc., an assistant foreman can yield good returns for his salary, at the same time performing the duties of trackwalker. A hand speeder should be furnished to permit the carrying of the necessary tools and material to take care of light repairs and to enable him to get over the section faster and have more time left for his other work. The gang could also be notified without

delay when conditions were found requiring their presence.

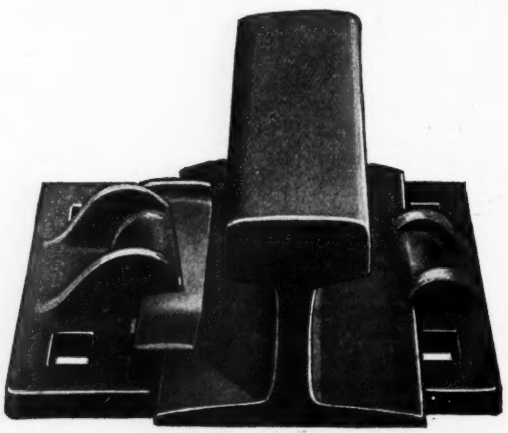
Employees in this capacity would become accustomed to responsibility and make good material for foremen. The foreman would have greater freedom with his mind more at ease to push the work continually with the main gang, knowing that a responsible man was covering the track and taking care of the small jobs which cause him so much annoyance and loss of time. As often as was necessary he could exchange places with the assistant, covering the track himself. Labor would have this added chance of promotion, inducing them to stay on the job. All things considered, it would result in more effective inspection, bolster up the organization generally and save money for the company.

A RAIL-ANCHOR TIE PLATE

A NEW RAIL-ANCHOR tie plate has been developed in which the anchorage to the rail is accomplished by means of a wedge of unique design. The plate is provided with a ribbed bottom and four spike holes to insure a thorough hold on the tie. The top of the plate has two jaws, one to grip the edge of the rail

The Tie Plate and Wedge

flange and the other to hold a special split wedge. This wedge is of such a shape that when in position its back is against the jaw grip, while one leaf lies above the rail base, and the other one is underneath it, that is, the rail flange is gripped between the two leaves. To overcome any possible loosening of the wedge, the upper leaf or flap of the wedge is made longer than the lower one, so that when it is in position it comes in contact with a riser on the tie plate that serves to bend it up and thus lock the



Tie Plate Assembled on a Rail

wedge against backing out unless driven out by striking the flange provided on the head of the wedge.

A summary of the arguments advanced for this device includes the claims that it is effective at all temperatures or conditions of weather, that all parts are visible, that it cannot be loosened by frozen ballast or vibrations of the track and that it furnishes a combined tie plate and anti-creeper at the cost of a good tie plate. The device is known as the Trasco rail anchor plate and is manufactured by the Track Specialties Company, New York.

THE MATERIAL MARKET

AS REPORTED BRIEFLY in last month's issue, Director-General Hines failed to abide by the results of the price establishing conference and has refused to be governed by the prices proposed. The controversy which followed his decision is a rather long story, but the gist of the director's objection is that one department of the government had no authority to establish prices to govern purchases of another department. He has also intimated that the figures, particularly for rail ($45 for Bessemer and $47 for open hearth) should be lower—$30 to $35 have been mentioned as conforming more nearly to his ideas. On the other hand, Judge Gary is quoted as saying that the actual cost of rail rolled by the United States Steel Corporation is $45 for Bessemer and $40 for open hearth, but just why Bessemer rails should cost more than open hearth rails is not explained. A new aspect has been placed on the situation just recently by a cable from the President asking for further negotiations.

Just at present it would appear that the plan for establishing prices will go by the board, but in the meantime the current quotations for steel items used in the railway maintenance field are those recommended by the price conference. Some of these are given below.

	Prices in Cents Per Pound	
	Pittsburgh	Chicago
Plates	2.65	2.92
Shapes	2.45	2.72
Bars (steel)	2.35	2.62
Track Spikes	3.35	3.62
Track Bolts	4.35	4.62
Angle Bars	2.75	2.75
Tie plates, steel	2.75	2.75
Tie Plates, iron	2.75	2.75
Wire Nails	3.25	...
Barb Wire, galvanized	4.10	...

Buying is very limited, and it is a question whether these prices can be maintained, there being repeated rumors of departures from this schedule. Several railroads have made inquiries for track materials, but no orders have been placed. With the completion of government contracts and the replenishing of warehouse stocks there is less and less for the manufacturer to do, so that a number of plants have been compelled to shut down.

The prices for cement have been lowered slightly, the reduction ranging from 2 to 10 cents per barrel. At the same time the charge for cloth sacks has been reduced from 25 cents to 15 cents each, while paper bags are now charged at 25 cents per barrel. Prices in carload lots for cement in sacks, but without the charges for them, are as follows:

Chicago	2.00	Cleveland	2.22
Pittsburgh	2.05	Indianapolis	2.17
Milwaukee	2.11	Duluth	2.10
St. Paul	2.30	Davenport	2.14

The lumber manufacturers, who were slated for a conference with Chairman Peck of the price conference following the conclusion of the discussion of steel prices, refused to enter into the conference after the failure of the plan with regard to iron and steel. In the meantime the lumber men are talking optimistically of increased business and coming advances in lumber prices, but some purchasers are inclined to look upon this as a case of "whistling to keep up courage." Considerable uncertainty exists as to the true status of the tie market. Many of the large producers are reporting decreased production with threatened cessation of operations in some localities, but reports from Railroad Administration headquarters are of a much more favorable tone. One evidence of unusual conditions in the tie market is the shipment of ties by water from the Pacific Coast.

GENERAL NEWS DEPARTMENT

Domestic commercial telegraph rates were increased 20 per cent on April 1 by an order of the Postmaster General.

The Colorado Midland, which was slated to be abandoned and scrapped about a year ago, is now the subject of consideration for purchase by the State of Colorado.

W. G. McAdoo of New York City, former Director-General of Railroads, has been appointed special counsel to the Railroad Administration on matters arising in the State of New York, to serve without pay.

The traffic on the railways continues to decrease. The tonnage of grain, coal and live stock handled during the month of March in the Central Western region showed a decrease of 27.3 per cent, 38.3 per cent, and 18.3 per cent respectively, as compared with the same month last year.

Safety work, according to a report made by the United States Railroad Administration, occupied the activities of 20,156 railroad men serving on railroad safety committees, under the direct supervision of the Safety Section of the administration.

Director-General Hines has entered into an agreement with the car and locomotive equipment companies to issue certificates of indebtedness similar to those issued to the railroads and for the amounts now due. It is understood that these certificates may be used as collateral on loans from the banks.

The United States Railroad Administration has authorized the expenditure of $1,000,000 for advertising calculated to stimulate passenger travel. This money will be expended in newspapers and magazines and for informative booklets exploiting localities attractive for winter or summer vacation tours, etc.

The Supreme Court of North Dakota on April 2 issued a mandamus restraining the Northern Pacific and other roads from charging within that state the increased passenger and freight rates established last June by the Director-General. It is understood that the Railroad Administration will appeal this decision to the Supreme Court of the United States.

The Interstate Commerce Commission recently issued a set of regulations prescribing the method of competitive bidding as provided in section 10 of the Clayton law on all contracts with or purchases amounting to over $50,000 from companies or persons with which there is an interlocking relationship. The carriers and the Director-General are given until May 15 to file objections. The law has been suspended, but became effective on January 1.

Representative John J. Esch, the next chairman of the House Committee on Interstate and Foreign Commerce, is making preparations for beginning active consideration of proposed railroad legislation as soon as Congress is called in extra session, which it is now believed in many quarters will be by June 1. Mr. Esch's views, in a general way, correspond to the plan suggested by the Interstate Commerce Commission before the Senate Committee.

Several thousand new standard cars built for the United States Railroad Administration have not been stenciled with the name of any railroad, as the companies which were expected to take them and pay for them are now refusing to accept them because the cars are not required to handle the traffic at the present time owing to the great car surplus, and the roads do not want to pay war prices for them. Over 26,000 of the 100,000 standard cars ordered have been accepted by the roads.

One of the very few new railroad lines under construction during the last year is the San Diego & Arizona, a 148-mile line extending east from San Diego to a connection with the Southern Pacific at El Centro. It is located in a difficult country along the Mexican border, part of it within the limits of Mexico. The approximate cost is $16,500,000. The entire line is now completed except for a section 11 miles long in Carriso gorge, in which there are eleven tunnels with an aggregate length of 13,392 ft.

Engineers, conductors, firemen and other trainmen received a further advance in wages amounting to about 9 per cent or a total additional increase in annual payment to employees of this class of about $55,000,000, through an order issued by Director-General Hines during the second week of April. In the same order in which this increase was given the matter of the justification of time and one-half for overtime was referred to Adjustment Board No. 1 of the Railroad Administration, which is composed of four railway officers and four employees.

Progress in valuation work, according to a statement made by Director Prouty before the Appropriations Committee of the House of Representatives on February 3, 1919, is such that road and track parties in all districts will substantially complete their work this year. Four parties have already been disbanded in the Pacific district and five in the Southern district. Land and field and accounting work will be completed in about two years, while the office work will be completed in about three years. It is estimated that the Division of Valuation will receive completed reports from the engineering section on 50,000 miles of road during 1919, similar reports having been received on 25,000 miles of road up to January 1 of this year.

The Thirteenth Engineers (Railway), which was organized in Chicago and has just returned to this country, has earned an enviable record for its performance during the war. One recognition of its valor and service is in the form of a letter of commendation written by Brig.-Gen. Moseley, assistant chief of staff, at the order of General Pershing, commander-in-chief of the American Expeditionary Forces. On February 22, 31 officers and men of this regiment were awarded the croix de guerre. This list included Capt. W. Haberlaw, formerly roadmaster on the Chicago, Rock Island & Pacific at Rock Island, Ill.; Capt. J. W. Kern, formerly supervisor on the Illinois Central at Mounds, Ill., and Lieut. H. Halverson, formerly roadmaster on the Chicago & North Western at Eagle Grove, Iowa.

The Federal Liquidating Association has been formed to facilitate and hasten the liquidation of reduced, suspended, terminated or canceled war contracts, whether formal or informal. This organization is headed by Brig.-Gen. Hugh S. Johnson, while the accounting of the association will be under the direction of Lieut.-Col. R. H. Montgomery. Others who will share in the direction of the association are W. S. Symington, president of the Symington Corporation; C. J. Symington, president of the Symington Machine Corporation, and H. H. Dinneen. The Washington headquarters of the association are in the Munsey Building, Washington, D. C. Local offices will be established at New York, Boston, Philadelphia, Baltimore, Rochester, Pittsburgh, Cleveland, Detroit, Bridgeport, Cincinnati, Chicago and St. Louis.

During the months of January and February the net operating income of the railroads under government control was less than the amount necessary to pay the guaranteed return to the owners by $73,000,000, or over a million dollars a day. The summary of operating expenses as reported by the Interstate Commerce Commission contains the following figures:

	January and February 1919	1918
Railway Operating Revenues	$748,798,750	$575,433,966
Railway Operating Expenses	685,100,224	532,922,088
Net Revenue from Railway Operations	63,698,526	42,511,878
Railway Operating Income	33,312,979	13,138,353

The expenditures for maintenance of way and structures during these two months were $112,403,862 and $79,811,134 respectively for 1919 and 1918, or an average of $482 per mile in 1919 and $342 per mile in 1918.

PERSONAL MENTION

GENERAL

William J. Wilgus, formerly chief engineer and later vice-president of the New York Central, has been awarded a distinguished service medal, by order of General Pershing. Mr. Wilgus served throughout the greater period of our participation in the war as deputy director-general of transportation in France, with the rank of colonel. He was a member of the first commission sent abroad to prepare for the handling of our army and its supplies in France.

ENGINEERING

E. F. Mitchell, chief engineer of the Texas & Pacific, with office at Dallas, Tex., has had his jurisdiction extended over the Fort Worth Belt and the International & Great Northern (Spring to Fort Worth and Madisonville branch).

D. C. Fenstermaker, assistant engineer on construction on the Chicago, Milwaukee & St. Paul, has been promoted to district engineer with headquarters at Chicago in charge of the Iowa, the Des Moines, the Kansas City, the Sioux City and Dakota and the Dubuque divisions.

Harold R. Miles, assistant engineer on the Canadian Pacific railway, with headquarters at Montreal, has been promoted to division engineer with headquarters at Winnipeg, succeeding **H. K. Yorston,** who has been appointed locating engineer on the Canadian Pacific, Western Lines. Mr. Miles was born at Lethbridge, Alb., in 1879, and entered railway service in March, 1899, with the Washington County Railway Company in Maine. In 1900 he was in the service of the Algoma Central on location work, and one year later became employed by the Canadian Pacific as an assistant engineer on maintenance, with headquarters at North Bay, Ont. Later he became resident engineer of maintenance on the Lake Superior division, where he remained until July 1, 1915, when he was transferred to Montreal as assistant engineer.

Walter Shepard, consulting engineer of the Boston & Albany, with headquarters at Boston, Mass., retired under the pension rules on March 1, after 44 years of continuous service in the engineering department of that road. He was born on March 1, 1849, at Dorchester, Mass., and graduated from Harvard University in 1870. In 1872 he graduated from the Massachusetts Institute of Technology, and in June of the same year began railway work with the Boston & Albany as an engineer's assistant. He was then out of railway work until March, 1875, when he returned to the service of the Boston & Albany. In April, 1882, he was promoted to division engineer and was made assistant chief engineer in December, 1886. He served as chief engineer from November, 1891, until May, 1908, and since that time as consulting engineer of the same road.

Walter Shepard

C. S. Ogilvie has been appointed assistant engineer on the Grand Trunk, with headquarters at Ottawa, Ont., in place of **H. Mowat,** assigned to other duties. Mr. Ogilvie was formerly assistant engineer on the Grand Trunk at Belleville, but went overseas with the first contingent of the Canadian Expeditionary Force in the 13th Royal Highlanders. He was a prisoner in Germany for more than three years, being released after the signing of the armistice.

Philip Petri, until recently district engineer on the Baltimore & Ohio, Eastern Lines, with office at Pittsburgh, Pa., has been appointed division engineer, with headquarters at Cumberland, Md., vice **W. T. Hughes,** transferred.

A. A. Woods, superintendent of the New Orleans & Northeastern, with office at Hattiesburg, Miss., has been appointed chief engineer maintenance of way and structures, of the Southern Railroad lines and associated railroads, lines west, with office at Cincinnati, Ohio, vice **Curtis Dougherty,** deceased.

E. W. Hammond, division engineer on the Buffalo, Rochester & Pittsburgh, with office at Du Bois, Pa., has been promoted to acting engineer maintenance of way, with headquarters at Rochester, N. Y., vice **G. C. Cleaver,** granted leave of absence, and **J. B. Oatman,** roadmaster, at Du Bois, has been promoted to acting division engineer, with headquarters at Du Bois.

Charles Harry Fox has been appointed division engineer on the Canadian Pacific, with headquarters at Regina, Sask. He was born at Winnipeg, Man., on April 2, 1885. He began his railway career in May, 1902, with the Canadian Pacific, serving as clerk, rodman and transit man in the maintenance department until 1906 and the following three years as transit man in the construction department of the same road. From 1904 to 1910 Mr. Fox attended McGill University, Toronto, Ont., and upon his graduation was appointed resident engineer on the Canadian Pacific, in which capacity he had charge of the construction of terminal docks, elevators and coal handling facilities at Fort William, Ont. The following year he was appointed assistant division engineer on the Manitoba division, in which capacity he served for three years, when he was appointed resident engineer of maintenance, with headquarters at Winnipeg. During 1918 he was engaged in military service and upon his release from the army he was appointed division engineer, as noted above.

TRACK

Lewis A. Bolan, extra gang foreman on the Northern Iowa division of the Chicago & North Western, has been appointed acting roadmaster on the second district of that division, with headquarters at Eagle Grove, Iowa. Mr. Bolan was born at Scranton, Iowa, on January 16, 1872, and entered railway service in February, 1889, as a section laborer with the Chicago & North Western at Scranton. In April, 1895, he was promoted to section foreman with the same headquarters. In April, 1903, he was transferred to the Northern Iowa division, where he acted as section, yard and extra gang foreman until his recent appointment.

George B. Schroyer, assistant supervisor on the Pennsylvania Railroad, with headquarters at Perryville, Md., has been appointed acting division operator on that road with headquarters at Wilmington, Del. Mr. Schroyer was born at Dillerville, Pa., in October, 1886. He was educated at Franklin & Marshall College and Bucknell University, graduating from the latter in 1910. In 1901 to 1903 he was a telegraph student on the Pennsylvania Railroad and during the summer vacations of 1905 to 1909, inclusive, he worked on that road as clerk and chainman. In 1910 he entered the employ of the Pennsylvania Railroad as rodman, in which position he remained until 1916, being stationed at Harrisburg, Pa., and Altoona. In 1916 he was made transitman at Philadelphia and later in that year was appointed assistant supervisor at Jersey City, N. J., from which position he was transferred in 1918 to Perryville, Md., as assistant supervisor, as noted above.

BRIDGE AND BUILDING

A. T. Hawk, architect of the Chicago, Rock Island & Pacific, with headquarters at Chicago, has been appointed engineer of buildings with the same headquarters, and his former position has been abolished.

PURCHASING

R. L. Irwin, purchasing agent of the Texas & Pacific, with headquarters at Dallas, Tex., has had his jurisdiction extended over the Fort Worth Belt and the International & Great Northern (Spring to Fort Worth and Madisonville branch).

OBITUARY

Allen T. Fraser, chief engineer of the Canadian National Railways, Western Lines, with office at Winnipeg, Man., was killed by a snow slide near Mount Robinson in the Yellowhead Pass, on March 31. Mr. Fraser was 46 years of age and had been in the service of the Canadian Northern railway for many years. He was formerly district engineer of that line at Edmonton, but in January last was promoted to the position of chief engineer of the Western Lines with headquarters at Winnipeg. A more complete sketch of Mr. Fraser's railway career appeared in the *Railway Maintenance Engineer* for March, page 111.

Curtis Dougherty, chief engineer maintenance of way and structures of the Southern System, Lines West, with headquarters at Cincinnati, Ohio, died at his home in that city, from pneumonia, on March 30. He was born at Otterville, Ill., on July 30, 1863, and received his education at Washington University, St. Louis, Mo., graduating in 1885. He began his railway career in 1887 in the office of the chief engineer of the Wisconsin Central, and the following year he was employed as an engineer with the Chicago & Western Indiana, in which capacity he served until March 1, 1892, when he entered the employ of the Illinois Central as an assistant engineer. From June 1, 1893, to June 1, 1902, he was roadmaster of the Chicago division, and upon the latter date was appointed superintendent of the Springfield division of the same road. On January 15, 1907, he resigned this position to become assistant chief engineer of the Cincinnati, New Orleans & Texas Pacific and the Alabama Great Southern, which position he held until the consolidation of these lines with the Southern system, when he was appointed chief engineer maintenance of way and structures of the Western Lines.

Curtis Dougherty

The railway legislative bill introduced in the House of Commons of England on February 27, proposing the establishment of a Ministry of Ways and Communications in control of practically all means of transportation in the United Kingdom and Ireland, passed to its second reading without a division, and was committed to a standing committee on March 18, following a two days' discussion in the House and a detailed explanation of its terms by Sir Eric Geddes, who is slated to be the first minister. Strong opposition was presented to the bill on the part of the road transportation and dock interests, both in the press and during the two days' discussion of the bill in the House of Commons, but without effecting a change in the bill or without impeding its progress. This opposition centered around the idea of putting such extensive powers in the hands of one man—more particularly in the hands of a man who was likely to work out the problems concerning the road and dock interests from a railroad point of view. Labor has been in favor of the bill, one labor member even going so far as to express his approval of it in the discussion because it would represent an important step in favor of ultimate nationalization.

FOREIGN RAILWAY NEWS

A railway is about to be built in Andalusia, Spain. It will extend from Zafra, Province of Huelva, to Villanueva de Fresno, Province of Badajoz, a distance of over 100 kilometers (62 miles) at an estimated cost of approximately $6,000,000, of which $500,000 is to be devoted to the purchase of rolling stock.

Railways in Portugal are in poor condition. The roads in this country include the two government owned lines aggregating 733 miles, and five privately owned lines aggregating 1,314 miles. It is expected when normal conditions return the government and the private companies will be able to improve the roads as well as replace and repair rolling stock.

The Russian Railway Commission has sold 6,500 tons of rails and accessories which its plans indicate it will not be possible to include in the large shipments of railway materials that are now being forwarded to Siberia for the use of the Stevens commission. This sale has been brought about through the fact that a large accumulation of rails has been diverted to the commission through the reconsignment of rails by the War Department.

Imports of rails and track fastenings in Brazil, according to a booklet issued by the Brazilian Minister of Agriculture, Industry and Commerce, amounted to 5,527 tons of a value of $780,000 in 1917, as compared to 621,547 tons of a value of $11,245,000 in 1913. Of these amounts 5,353 tons costing $754,000 came from the United States in 1917, as compared to 46,639 tons of a value of $1,959,000 from the United States in 1913.

A tunnel under the Shimonoseki strait between the islands of Moji and Kiushu of the Japanese archipelago is one of the newest undertakings up for consideration, although this project has been proposed previously. The tunnel would be 3½ miles long, of which 1 mile would be under the water. The project will cost $8,973,000 to $9,970,000 and require 10 years' time. It has been placed in charge of Doctor Tanabe, who is conected with the engineering college of the Imperial University, Kyoto.

Exports of railway material from the port of New York, during February, according to figures of exports compiled by the National City Bank of New York, included the following:

Steam passenger cars	$40,708
Steam freight cars	211,151
Car wheels and axles	165,771
Steam locomotives	1,990,171
Railroad spikes	216,497
Steel rails	3,178,224
Switches, frogs, etc.	445,933

The fifteenth Annual Rural Congress of Uruguay has recommended the construction of three bridges, the most important of which would cross the lower bar of the Santa Lucia river in the vicinity of Montevideo, the probable length of the structure being about 1,640 ft., not including approaches. The bridge, which would place the southern part of the Department of San Jose in easy communication with Montevideo and give new life to the state-owned Ferrocarril del Norte, has been under consideration for a number of years. Some time before the war a definite project was drawn up and contracts for the building of the bridge were let. About $400,000 was expended in the erection of the substructure, the work being done by a Montevideo firm. The superstructure was contracted for with a German firm, which was unable to secure shipment of its materials on account of the war. This contract has since been canceled by the Uruguayan government.

The consulate is informed that no decision has been taken with respect to a second call for tenders and that it is not know whether such a call would be based on the original or new specifications. Copies of the plans used for the first

call may be obtained from the Direccion de Vialidad, Ministerio de Obras Publicas, Montevideo, at a cost of 3.50 pesos ($3.62).

The study of the Tangier-Fez Railway scheme in Morocco was suspended at the outbreak of the war, but lately the project has been taken up again, the plans, etc., have been proceeded with, and actual work has commenced on some sections in the French zone. The construction of the line will presumably proceed as quickly as possible. The public works in progress in the Spanish zone on the outbreak of the war were harbor works at Laraiche and a railway between that port and Alcazar, both of them in the hands of a German company. The former has been handed over to the Spanish authorities in an incomplete state, and the work on the railway has been practically at a standstill for some time. This railway, as also the Spanish zone section of the Tangier-Fez railway, with which it will connect, will presumably be pushed on when circumstances permit. A light railway has been built connecting Centa with Tetuan, and a line to join up the latter place with the Tangier-Fez railway is contemplated, but it is not likely to be taken in hand for some time.

MEXICAN DEVELOPMENTS

The Southern Pacific of Mexico is now in operation from Nogales on the Mexican border south of Tucson, Ariz., to Mazatlan on the Pacific Coast, about 500 miles south of the border. An enormous amount of rehabilitation work is necessary to bring the road up to physical standards and considerable quantities of steel rails are being imported from the United States. A syndicate of Americans and Mexicans has asked for a concession from the Mexican government for the construction of a line paralleling the border between Mexico and the United States from Ensenada on the west coast of Lower California to Tia Juana, thence eastward to Mexicali, thence crossing into Arizona just above the head of the Gulf of California, then south into the state of Sonora, with branch lines to several mining districts and towns, thence eastward along the border into the state of Chihuahua to Juarez, opposite El Paso, thence south eastward to Ojinaga opposite Presidio, Tex. The complete development involves more than 2,000 miles of line. It is said that construction is now in progress on a line to connect Durango with Mazatlan involving a very difficult crossing of the Sierra Madre mountains, which work is being done by the Carranza government.

The Carranza government is also proposing the purchase of the United Railways of Yucatan, now owned by a syndicate of bankers and sisal fiber growers of Merida, but it is considered doubtful if the plans will be put through. The system of road covers 1,141 miles of line, including branch lines of considerable extent. Another plan for the betterment of rail facilities in Yucatan is a scheme for connecting the lines of Yucatan with those of the rest of Mexico through the construction of a 450-mile connection from Santa Lucretia on the National Tehuantepec railroad to Campeche, a point on the existing Yucatan line.

Current railway developments on the Pacific slope of Mexico include the construction of a 25-mile railway from La Capilla on the Guadalajara-Irapuato division of the National Railways of Mexico to Lake Chapala, the town by the lake with that name. This has been completed and opened for regular freight and passenger traffic, affording direct rail access to one of the most delightful pleasure and health resorts in Mexico.

Further improvement in this same territory is the restoration of traffic on the Guadalajara-Manzanillo line of the National Railway of Mexico. Temporary repairs have been made to the track, bridges and other parts of the road and a large amount of permanent reconstruction work will be done as soon as the materials can be obtained, it is stated. The federal government plans to make important improvements to the port facilities at Manzanillo. In order to develop the transcontinental traffic between Manzanillo and Tampico low freight rates will be established. The line that runs from Guadalajara to Manzanillo was originally a part of the old Mexican Central system.

SUPPLY TRADE NEWS

SELLING AGENCIES APPROVED.

In a statement issued on April 15, Walker D. Hines, director general of railroads, announced that with the approval of Attorney General A. Mitchell Palmer he had consented to a modification of the covenant inserted in purchase contracts under the direction of the Department of Justice issued June 18, 1918, prohibiting the payment to agents of fees contingent upon the procuring of contracts with the Government in so far as it relates to railroad contracts. Hereafter this order will not affect contracts made between the Railroad Administration and supply houses, which, previous to government control, carried on their business through bona fide selling agencies. At the suggestion of John Barton Payne, general counsel for the Railroad Administration, the following clause will be inserted in appropriate cases in future railroad contracts:

"Provided, however, that this covenant shall not invalidate a contract obtained through a bona fide commercial representative employed under a general contract covering designated territory and shall not prohibit or penalize the employment of the same agencies, rates and methods of compensation in dealing with the United States heretofore customarily employed by the contractor in the regular course of his business in similar dealings with the railroad corporations."

GENERAL

The Iowa Steel Post Company has moved its offices and factory from Waterloo, Iowa, to Fort Dodge.

The name of the Aspromet Company or Asbestos Protected Metal Company of Pittsburgh, Pa., manufacturer of roofing, siding, ventilators and skylights, was changed to the H. H. Robertson Company, effective April 1.

The Interstate Iron & Steel Company, Chicago, has opened a branch office at Detroit, Mich., with R. B. Dutch in charge of sales in that territory. Mr. Dutch has been identified with the iron and steel industry for several years.

The American Blower Company, Detroit, Mich., has purchased a plot of ground containing approximately 15 acres upon which it intends to build a new plant. Plans are now being prepared for the construction of a foundry upon which work will be started in the near future.

The Chicago Pneumatic Tool Company has discontinued its branch office at Wichita, Kan., and has transferred the stock from that place to Eldorado, Kan., where an office and warehouse have been established. A new office has also been opened by the company at Tulsa, Okla.

The Toledo Pipe Threading Machine Company, Toledo, Ohio, has organized a "Toledo Ten-Year Club," whose membership will be limited to owners of a Toledo Pipe Threader machine that has been in service ten years. All applications for membership must be in by July 1, 1919, and on that date the six members owning the six oldest "Toledos" will be notified and be given their choice of a Toledo Ratchet Threader complete or a Toledo No. 0 tool.

The E. I. du Pont de Nemours Export Company has been organized by E. I. du Pont de Nemours & Co., Inc., as a subsidiary corporation, created for the purpose of handling foreign business, effective April 1, 1919. The officers of the new company are as follows: F. W. Pickard, president; W. S. Gavan, vice-president and director of sales; F. D. Brown, treasurer; Alexis I. du Pont, secretary. The same staff which has previously been associated with the Du Pont export business will be continued with some additions made necessary by the broader scope of the new corporation. The main offices will be located at 120 Broadway, New York, with branches in San Francisco, Mexico City, London and Rio de Janeiro.

Wheeler, Mechlin & Rhea is the name under which this recently organized firm conducts an advisory and purchasing engineering business in New York. It is organized to furnish service to foreign and domestic clients purchasing machinery and engineering materials in the United States, to be used to construct, maintain and operate properties.

The Railway Business Association's committee on government purchasing policies was organized in New York City last week. The chairman of the committee is Knox Taylor, president of the Taylor-Wharton Iron & Steel Company, High Bridge, N. J.; and the other members are Samuel G. Allen, vice-chairman, Franklin Railway Supply Company, New York; G. S. Brown, president, Alpha Portland Cement Company, Easton, Pa.; Andrew Fletcher, president, American Locomotive Company, New York; Howard A. Gray, manager railroad sales, Joseph T. Ryerson & Son, Chicago; A. L. Humphrey, president, Union Switch & Signal Company, Swissvale, Pa.; A. H. Mulliken, president, Pettibone, Mulliken & Co., Chicago; L. G. Parker, assistant manager of sales, Cleveland Frog & Crossing Company, Cleveland, Ohio; W. H. Woodin, president, American Car & Foundry Company, New York.

PERSONAL

I. H. Cohn, formerly of the National Steel Rail Company, has become associated with the Standard Rail & Steel Company, St. Louis, Mo., and will be in complete charge of the rail department, handling all matters relative to relaying rails and railroad equipment. The company's plant, covering 15 acres in Madison ,Ill., is now nearing completion.

J. M. Borrowdale, formerly superintendent of the car department of the Illinois Central and for the past two years sales representative of the H. W. Johns-Manville Company at Milwaukee, Wis., has been appointed sales representative in the railroad department of the Liberty Steel Products Company, Inc., with offices in the McCormick building, Chicago.

William H. Basse has been appointed manager of the Joseph T. Ryerson & Son, Detroit plant, Detroit, Mich. Mr. Basse has been in the employ of the Joseph T. Ryerson & Son since November, 1900, and for the past 10 years has held various positions in the sales department at Chicago. In August, 1918, he was transferred to the Detroit office as acting manager of the Detroit plant, succeeding Ralph J. Stayman resigned.

Captain L. R. MacKenzie, engineer of highways on the staff of the commanding general of the port of embarkation at Newport News, Va., and who for the past 12 years identified with highway work in the middle West and along the Pacific coast, both as an engineer and contractor, has been appointed district engineer of the Portland Cement Association in charge of the new district office located in the Hubbell building, Des Moines, Iowa.

Charles H. Florandin has been appointed general manager of the Eastern territory for the American Steam Conveyor Corporation, Chicago, with headquarters at New York. Mr. Florandin was born in France and received his technical education at the Lycee de Marseilles. After coming to the United States he was employed for five years on the Brooklyn City Railway at the time it was being electrified, after which he went with the C. & E. Electric Company, New York, with which company he was connected for many years, later organizing the National Electric Welding Company. During the war Mr. Florandin was a member of the Welding committee of the Emergency Fleet Corporation.

Lieut.-Com. H. J. Elson, United States Naval Reserve Force, has been released from active service and has resumed his civilian work as secretary and treasurer of the Walter A. Zelnicker Supply Company, St. Louis, with which company he was in charge of internal management and manufacturing operations. Lieut.-Com. Elson is a graduate of the United States Naval Academy and saw active service in Cuba, the Philippines and China, resigning from the Navy in 1902 to become associated with the Walter A. Zelnicker Company. Following the declaration of war he was mobilized into federal service with the Missouri Naval Militia, which he was largely instrumental in organizing.

P. Harvey Middleton, executive assistant of the Railway Business Association, was invited by Senor M. Munoz, general superintendent of the Mexican National Railway Administration, during his recent visit to New York, to make a trip with him over all the lines under the control of the Carranza government. Mr. Middleton accepted the invitation.

Lieut.-Col. Merrill G. Baker has been elected president of the American International Steel Corporation, effective April 1. Colonel Baker was formerly assistant manager of sales of the Cambria Steel Company and has been for many years one of J. Leonard Replogle's right-hand men. He succeeds the late Edward M. Hagar, who died over a year ago. The American International Steel Corporation is a subsidiary of the American International Corporation.

F. V. Sargent has been appointed district manager of sales of the Chicago Pneumatic Tool Company with headquarters at Boston, Mass., succeeding **F. S. Eggleston,** resigned. Mr. Sargent was born in Belmont, Mass., on December 15, 1881. He began his business carer in 1905 with the Bethlehem Ship Building Company as a drafting clerk and was later in charge of the heat treatment department and physical laboratories. In 1914 he entered the sales department of that company, in which capacity he remained until he resigned to become district sales manager of the Chicago Pneumatic Tool Company.

Captain C. A. Duntley, who recently received his honorable discharge from the army after serving as captain in the 27th Field Artillery, has been elected vice-president of the Duntley-Dayton Company, with headquarters in the Westminster building, Chicago. He was born in Chicago on October 21, 1892, and received his education in the Armour Institute, Chicago, and Cornell University, from which latter school he graduated in 1914. Captain Duntley will have charge of the sales work of the pneumatic and electric tool department of the company, which consists of a complete line of portable electric drills and grinders, as well as a full line of accessories, such as hose and hose couplings, rivet sets and chisel blanks.

J. S. Hobson, western manager of the Union Switch and Signal Company at Swissvale, Pa., with office at Chicago, has been elected president of the Massey Concrete Products Corporation of Chicago at the annual meeting of the board of directors, succeeding C. F. Massey, who has been elected chairman of the board. Mr. Hobson began his railway career as an engineer apprentice on the Great Southern & Western at Dublin, Ireland, in which capacity he was employed from 1884 to 1889. He came to this country in 1889 and entered the employ of the Chicago, Burlington & Quincy as a locomotive machinist and draftsman. In 1892 he became associated with the Union Switch and Signal Company as a construction foreman in Chicago and St. Louis, and in 1896 he was appointed a signal supervisor on the Michigan Central, with headquarters at Detroit, Mich. The following year he entered the employ of the Atchison, Topeka & Santa Fe as signal engineer, with headquarters at Topeka, Kan., which position he held until 1901, when he returned to the service of the Union Switch & Signal Company as assistant engineer at Swissvale, Pa. In 1904 he was appointed assistant general manager, in which capacity he served eight years until he was promoted to western manager at Chicago. In 1914 he was made general sales manager,

J. S. Hobson

and in 1915 general manager, which position he held until 1916, when he was again appointed western manager at Chicago, in which capacity he will continue to serve the Union Switch and Signal Company, combining the duties of that office with those of president of the Massey Concrete Products Corporation.

Frank Walsh Haskell, president of the Carborundum Company, Niagara Falls, New York, died on April 2 at his winter home at Daytona, Fla. Mr. Haskell was born in Brooklyn, New York, in 1861. He was for a time in railroad service as a rodman in the engineer corps which laid out part of the lines of the Chicago, St. Paul, Minneapolis & Omaha. In 1885 he moved to Pittsburgh, and there affiliated himself with Henry C. Frick as secretary and treasurer of the Southwest Connelsville Coke Company, owned jointly by the Frick and the Illinois Steel companies. In 1897 he moved to Niagara Falls, representing the Mellon interests of Pittsburgh, and becoming president of the Carborundum Company, then in its infancy. This company, under his leadership, became the greatest abrasive manufacturing concern in the world.

F. W. Haskell

A. M. Mueller, manager of the St. Louis branch of Joseph T. Ryerson & Son Company of Chicago, has been promoted to general manager of sales, in which capacity he will have charge of all warehouse and mill products for all territory west of Pittsburgh. He was born at Plymouth, Ind., on July 30, 1874, and received his education in the public schools at that place. His business career dates back to 1899 when he first entered the employment of the Joseph T. Ryerson & Son as a clerk in the credit and cashier department. During this period he served successively as traveling salesman, Texas representative for three years and manager of the New York and Minneapolis offices until 1911, when he was appointed assistant manager of sales. Later he went to St. Louis, Mo., as manager of the Ryerson-Hagar plant, being recalled at the end of three years to handle the sales at the main plant at Chicago.

TRADE PUBLICATIONS

Duff Jacks.—The Duff Manufacturing Company, Pittsburgh, Pa., has issued a 16-page catalogue listing the various types of bridge, track, trench and other special jacks manufactured by that company. The jacks are catalogued in regular order with a small illustration, short description and table of capacities and limiting dimensions for each type.

Pumping Machinery.—The National Transit Company, Oil City, Pa., manufacturers of special machinery to meet the requirements of pipe line companies, has begun the manufacture of other machinery for general service. These include pumping machinery and gas and oil engines, which together with old lines are illustrated and described in various bulletins, which are bound in heavy manila covers in such a manner that others may be added from time to time.

Creosote Oil.—The Barrett Company, New York, has issued a 16-page booklet with the sub-title "When and How to Use Barrett Carbosota Grade 1 Liquid Creosote Oil." Two pages are devoted to a description and detailed plan of a simple and inexpensive wooden treating plant and several photographs of home-made plants are shown. The booklet includes full directions for the application of creosote oil and its various uses are treated of in detail, special attention being given to the treatment of poles and fence posts.

CONSTRUCTION NEWS

The Lehigh Valley has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a 750-ton capacity four track, automatic electric, reinforced concrete locomotive coaling plant and a 750-ton reinforced concrete sand-handling plant at Ashmore, Pa. The contract price is $75,000 and it is stated that installation will begin immediately.

The Illinois Central has awarded a contract to the Railway Water & Coal Handling Company, Chicago, for the construction of a concrete dam across the Tradewater river at Dawson Springs, Ky., to supply water for a pumping station. The dam will be of concrete construction, 14 ft. high by 125 ft. long and 10 ft. thick, and will cost approximately $6,000. This road has also awarded a contract to the same company for the construction of a pumping station with pumping equipment, the approximate cost of which will be $35,000.

The New Mexico Central may be extended through the San Juan basin of New Mexico to a connection with transcontinental lines south or west if an investigation now being made leads to a favorable conclusion. This line would tap coal fields and also serve mineral mines, saw mills and sulphur deposits, coal alone being estimated to furnish from 500 to 1,000 carloads of traffic daily. D. B. K. Sellers of Albuquerque, N. M., is interested in this project.

The Southern Railway has given a contract to M. M. Elkins, Macon, Ga., for building a bridge at Gaffney, S. C. The bridge and retaining wall approach will be of reinforced concrete construction. The structure will consist of three spans, one of which will be 35 ft. long and the other two 26 ft. long. The cost of the work will be about $30,000.

The Temiskaming & Northern Ontario desires separate bids for the construction of the roadbed, except steel bridges, on sections of line between Swastika and Kirkland Lake, 6 miles, and between Timmins and the Mattagami river, 2 miles. Separate bids for each section are also wanted for track laying, ballasting and fencing. W. H. Maund, Toronto, is secretary-treasurer.

United States exports of railway track material, by countries, February, 1919:

Countries	—Railroad Spikes— Pounds	Dollars	—Steel Rails— Tons	Dollars	Switches, Frogs, Etc. Dollars
Belgium	...	...	422	24,260	8,094
France	2,252,960	165,222	49,400	4,847,312	467,701
Italy	...	...	3,476	298,135	88,402
Netherlands	...	...	383	18,307	695
Norway	1,567	532	...	...	...
England	...	...	...	...	1,089
British Honduras	3,000	164	...	...	29
Canada	689,500	20,254	2,605	104,281	21,606
Costa Rica	...	...	...	...	135
Guatemala	2,000	124	...	...	...
Honduras	17,200	1,060	...	...	717
Nicaragua	9,000	639	76	4,643	79
Panama	7,245	503	...	...	147
Mexico	41,885	2,023	76	5,867	9,845
Barbados	...	...	68	7,000	...
Jamaica	8,000	424	59	3,095	...
Trinidad	...	...	9	689	54
Other British West Indies	...	...	...	...	52
Cuba	681,126	38,704	2,952	184,189	70,938
French West Indies	800	51	...	...	400
Dominican Republic	2,000	115	77	4,227	18,233
Bolivia	...	...	...	...	9,000
Brazil	230,740	14,232	...	...	113,278
Chile	23,000	1,853	4	445	4,021
Colombia	28,000	1,966	233	14,710	...
British Guiana	4,050	280	51	3,712	239
Peru	42,111	2,986	571	41,893	46,198
Uruguay	...	...	...	...	1,075
Venezuela	3,000	158	...	...	...
China	...	...	1,447	79,051	65
Japanese China	...	...	223	14,329	...
Straits Settlements	13,440	835	...	...	...
Dutch East Indies	...	...	351	36,351	14,926
French East Indies	...	...	...	...	3,825
Japan	123,734	5,132	3,474	268,102	18,577
Siam	7,600	240	...	...	...
Australia	470	37	...	...	...
Philippine Islands	13,800	539	826	56,209	5,520
British South Africa	...	...	117	6,775	324
Total	4,206,228	258,073	66,900	6,023,982	905,264